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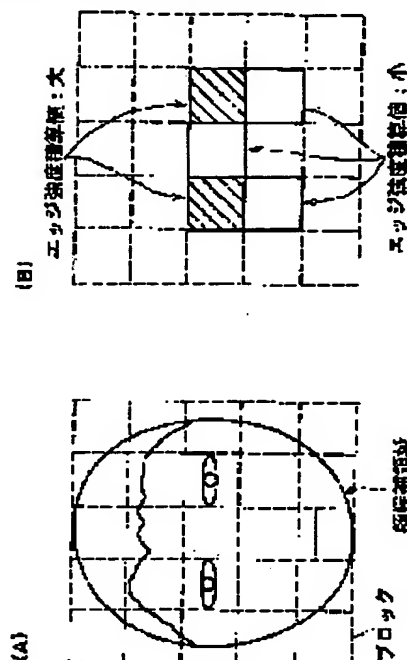
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(54) IMAGE PROCESSING METHOD, IMAGE PROCESSOR, AND RECORD MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To precisely extract an area corresponding to the face of a human through an easy process according to the internal structure of the face.

SOLUTION: A face candidate area considered to correspond to the face of the human is extracted from an image to be processed, the face candidate area is divided into a specific number of blocks (division patterns are shown by broken lines in (A)), and integral values of edge intensity in the top-bottom direction of the image are found, block by block. The feature quantities found for each block are collated with patterns for matching (cf. (B)) found by dividing the face area actually corresponding to the face of the human according to the division patterns and calculating edge intensity integral values for each block to evaluate the accuracy of the face candidate area as an area (face area) corresponding to the face of the human.



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limits of outside the aforementioned candidate field, and the aforementioned background candidate field was extracted, and was extracted is beyond a predetermined value, Or the image-processing method which makes low evaluation of the accuracy as a field equivalent to the principal part to the aforementioned candidate field when the extracted background candidate field is unevenly distributed in the periphery section in a picture.

[Claim 6] The image processing system characterized by providing the following. Equivalent to the face of the person in the picture which this image data expresses based on image data, then 1st extraction means to extract the candidate field presumed. While dividing into the small field of a predetermined number the candidate field extracted by the extraction means of the above 1st An operation means to calculate the characteristic quantity relevant to the concentration in a small field or the frequency of change of brightness, and the size of change for every smallness field, By collating with the pattern showing the relation of the aforementioned characteristic quantity for every smallness field when dividing into the small field of the aforementioned predetermined number the field which is equivalent to a person's face in the characteristic quantity calculated for every aforementioned smallness field by the aforementioned operation means An evaluation means to evaluate the accuracy as a field equivalent to the face of the person of the aforementioned candidate field.

[Claim 7] The image processing system characterized by providing the following. Equivalent to the face of the person in the picture which this image data expresses based on image data, then 1st extraction means to extract the candidate field presumed. The 2nd extraction means which extracts the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced based on the distribution of the concentration in the candidate field extracted by the extraction means of the above 1st, or brightness, The position in a candidate field of the field which carried out [aforementioned] extraction, surface ratio with a candidate field, An evaluation means to evaluate the accuracy as a field which judges the adjustment as a field equivalent to the aforementioned specific portion of the field which carried out [aforementioned] extraction based on at least one of the configurations of the histogram of concentration or brightness, and is equivalent to the face of the person of the aforementioned candidate field.

[Claim 8] While dividing equivalent to the face of the person in the picture which this image data expresses then the 1st step which extracts the candidate field presumed, and the candidate field which carried out [aforementioned] extraction into the small field of a predetermined number based on image data The 2nd step which calculates the characteristic quantity relevant to the concentration in a small field or the frequency of change of brightness, and the size of change for every smallness field, By collating with the pattern showing the relation of the aforementioned characteristic quantity for every smallness field when dividing into the small field of the aforementioned predetermined number the field which is equivalent to a person's face in the characteristic quantity calculated for every aforementioned smallness field The record medium with which the program for making a computer perform processing containing the 3rd step which evaluates the accuracy as a field equivalent to the face of the person of the aforementioned candidate field was recorded.

[Claim 9] Equivalent to the face of the person in the picture which this image data expresses based on image data, then the 1st step which extracts the candidate field presumed, The 2nd step which extracts the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced based on the distribution of the concentration in the candidate field which carried out [aforementioned] extraction, or brightness, The position in a candidate field of the field which carried out [aforementioned] extraction, surface ratio with a candidate field, Based on at least one of the configurations of the histogram of concentration or brightness, the adjustment as a field equivalent to the aforementioned specific portion of the field which carried out [aforementioned] extraction is judged. The record medium with which the program for making a computer perform processing containing the 3rd step which evaluates the accuracy as a field equivalent to the face of the person of the aforementioned candidate field was recorded.

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CLAIMS

[Claim(s)]

[Claim 1] While dividing equivalent to the face of the person in the picture which this image data expresses based on image data, then the candidate field which extracted the candidate field presumed and carried out [aforementioned] extraction into the small field of a predetermined number The characteristic quantity relevant to the concentration in a small field or the frequency of change of brightness, and the size of change is calculated for every smallness field. The image-processing method of evaluating the accuracy as a field which is equivalent to the face of the person of the aforementioned candidate field by collating with the pattern showing the relation of the aforementioned characteristic quantity for every smallness field when dividing into the small field of the aforementioned predetermined number the field which is equivalent to a person's face in the characteristic quantity calculated for every aforementioned smallness field.

[Claim 2] The image-processing method according to claim 1 characterized by dividing a partition-pair elephant field into the small field of the aforementioned predetermined number so that it may be located in the small field where the fields equivalent to each eye section which constitutes ***** of a person's face differ.

[Claim 3] Based on image data, considerable, then the candidate field presumed are extracted to the face of the person in the picture which this image data expresses. Based on the distribution of the concentration in the candidate field which carried out [aforementioned] extraction, or brightness, the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced is extracted. The position in a candidate field of the field which carried out [aforementioned] extraction, surface ratio with a candidate field, The image-processing method of evaluating the accuracy as a field which judges the adjustment as a field equivalent to the aforementioned specific portion of the field which carried out [aforementioned] extraction based on at least one of the configurations of the histogram of concentration or brightness, and is equivalent to the face of the person of the aforementioned candidate field.

[Claim 4] The field which the pattern of the concentration of a convex or brightness has produced in the direction of high concentration peculiar to the eye section or the low brightness direction of a face of a person is extracted. [whether the adjustment as a field corresponding to the aforementioned **** of the extracted field is judged, and] Or the image-processing method according to claim 3 which extracts the field which the pattern of the concentration of a convex or brightness has produced in the direction of low concentration peculiar to a gena or the high brightness direction of a face of a person, and is characterized by judging the adjustment as a field corresponding to the aforementioned gena of the extracted field.

[Claim 5] Based on image data, considerable, then the candidate field presumed are extracted to the principal part in the picture which this image data expresses. When the lightness of the candidate field which carried out [aforementioned] extraction is beyond a predetermined value, the background candidate field where the difference of lightness with the aforementioned candidate field consists of the pixel of predetermined within the limits When the surface ratio to the aforementioned candidate field of the background candidate field which it searched within the

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the image-processing method, an image processing system, and a record medium, and relates to the record medium with which the program for performing especially a person's image processing system which can apply [considerable, then] the image-processing method of extracting the field presumed, and the aforementioned image-processing method to a face and aforementioned image-processing method in a picture by computer was recorded.

[0002]

[Description of the Prior Art] When admiring a person photograph, in carrying out exposure record (it records by field exposure or scanning exposure) of the subject-copy image which the part which attracts attention most is a person's face, for example, was recorded on the photographic film etc. to record material, such as printing paper Although it is desirable to control exposure so that the color and concentration of a face of a person may become proper, in order to realize this exposure control, it is necessary to detect correctly the tint and concentration of a field equivalent to the face of the person in a subject-copy image. moreover, in the various image processings developed for the purpose of the improvement in quality of image of the picture which this image data expresses, to the image data obtained by reading a picture Although there are some which perform specific image processings (for example, local concentration amendment, bloodshot-eyes correction, etc.) only to the field equivalent to the face of the person in a picture or its part, in order to perform this processing, it is necessary to detect correctly the position and size of a field equivalent to the face of the person in a picture.

[0003] For this reason, considerable, then the technique for extracting the field presumed are variously proposed by the principal parts, such as a face of the person in a picture, from before. For example, it is based on JP,8-184925,A at image data. a configuration pattern (for example, the profile of a head —) peculiar to each part of the person who exists in a picture It searches for any one of the configuration patterns showing the profile of a face, the internal structure of a face, the profile of a fuselage, etc. While setting up the field (candidate field) where the adjustment as a field equivalent to a person's face is high according to the physical relationship of the predetermined portion the person's [whom the size of the detected configuration pattern, the sense, and the detected configuration pattern express], and a person's face It looks for other different configuration patterns from the detected configuration pattern, the adjustment as a person's face of the candidate field set up previously is evaluated, and considerable, then the extraction method of a face field of extracting the field (face field) presumed are indicated by a person's face.

[0004]

[Problem(s) to be Solved by the Invention] With technology given in the above-mentioned official report, binarization is dividing the picture of a processing object into the white field and the black field, for example, in a setup of a candidate field based on the internal structure of a face Based on considerable, then the black field which extracted the black field presumed and was extracted, the candidate field is set as the eye section of a person's face by judging respectively

adjustments, such as a configuration as a field equivalent to the eye section of a person's face, to each black field obtained by division. However, it is necessary to evaluate the field from which the above-mentioned processing including the field division by binarization was extracted by the multiple-times repeat and processing of each time, changing the threshold used for binarization, in order to extract the field equivalent to the eye section with a sufficient precision, since the density range of the picture of a processing object is not fixed and the concentration of the so-called portion of the iris of the eye of the eye section is not fixed, either. Therefore, there was a problem that processing took great time.

[0005] Moreover, when the field which is equivalent to the eye section of a person's face, for example, and fields which are comparatively equivalent to the high concentration section, such as the hair section, adjoin on a picture in binarization, there is also a problem that it becomes difficult to extract correctly the field which may combine with the black field in which the black field equivalent to the eye section is equivalent to other high concentration sections, and is equivalent to the eye section in this case. This problem may be similarly produced, if change of the concentration in the boundary of the field equivalent to the eye section and the field equivalent to other high concentration sections or brightness is small when dividing a picture based on the edge (portion from which concentration or brightness is changing beyond the predetermined value) which is indicated by the above-mentioned official report as a method of replacing with binarization and which was extracted from the picture.

[0006] Thus, in the conventional processing in which the internal structure of a face was used, when the field equivalent to the particular part inside the face which is a candidate for extraction has not been extracted correctly, there was a problem that the field equivalent to a person's face could not be extracted with a sufficient precision.

[0007] By the way, when the scene containing the principal parts, such as a person, is photoed, when a stroboscope is made to emit light and a photograph is taken, as for the field equivalent to the principal part in a picture, high brightness has more bird clappers than the field which is [include] equivalent to a background. For this reason, although the field of the low brightness also as a field equivalent to the principal part was excepted and the field of high brightness was extracted in many cases, when it was the picture which expresses the scene in which the picture of a processing object contains the principal parts, such as a person, under the lighting conditions of a backlight in connection with this, a part for the background of high brightness in a picture might be incorrect-extracted as a field equivalent to the principal part. In this case, supposing it controls the light exposure at the time of carrying out exposure record of the picture into record material based on the color and concentration of a field which were extracted, a record picture will become the unsuitable quality of image in which the field equivalent to the principal part collapsed black.

[0008] It is the 1st purpose to obtain the image-processing method, image processing system, and record medium which can extract the field which accomplished this invention in consideration of the above-mentioned fact, and is equivalent to a person's face based on the internal structure of a person's face with a sufficient precision by simple processing.

[0009] Moreover, it is the 2nd purpose to acquire the image-processing method which can suppress that this invention is incorrect-extracted as a field in which the field equivalent to the background in a picture is equivalent to the principal part.

[0010]

[Means for Solving the Problem] In order to attain the 1st purpose, the image-processing method concerning invention according to claim 1 While dividing equivalent to the face of the person in the picture which this image data expresses based on image data, then the candidate field which extracted the candidate field presumed and carried out [aforementioned] extraction into the small field of a predetermined number The characteristic quantity relevant to the concentration in a small field or the frequency of change of brightness, and the size of change is calculated for every smallness field. The accuracy as a field equivalent to the face of the person of the aforementioned candidate field is evaluated by collating with the pattern showing the relation of the aforementioned characteristic quantity for every smallness field when dividing into the small field of the aforementioned predetermined number the field which is equivalent to a

person's face in the characteristic quantity calculated for every aforementioned smallness field.

[0011] In invention according to claim 1, considerable, then the candidate field presumed are first extracted to the face of the person in the picture which this image data expresses based on image data. On the occasion of extraction of this candidate field, well-known arbitrary algorithms are applicable from before. Next, while dividing the extracted candidate field into the small field of a predetermined number, the characteristic quantity relevant to the concentration in a small field or the frequency of change of brightness, and the size of change is calculated for every smallness field. In addition, it can ask by performing integrating the variation of the concentration between the pixels which adjoin each other, for example along the predetermined direction as characteristic quantity relevant to the frequency of change of concentration or brightness, and the size of change, or brightness for every smallness field.

[0012] in the field equivalent to the face of the person in a picture, change of the portion from which concentration or brightness is changing intricately, and concentration or brightness is loose, or it exists respectively in the portion with almost uniform concentration or brightness, and the position of a **** about 1 law for example, within the subregion which corresponds on the eye section or the outskirts of it among the aforementioned fields From existing in the position where an eyeball, an eyelid, eyelashes, eyebrows, etc. approached, and concentration and brightness changing intricately also around the pupil in an eyeball, or the iris Concentration or brightness is changing frequently and a lot (the frequency of change of concentration or brightness and the size of change are large especially about the array directions, i.e., the vertical direction of a face, such as an eyeball, an eyelid, eyelashes, and eyebrows). Within the subregion which corresponds on a gena or the outskirts of it among the fields equivalent to a person's face on the other hand, although based also on lighting conditions, change of concentration or brightness is loose. Therefore, if a candidate field is a field equivalent to a person's face, the characteristic quantity which divided the candidate field into the small field of a predetermined number, and asked for it for every smallness field will serve as a value which is sharply different whether each smallness field corresponds to which portion of a person's face.

[0013] By collating with the pattern which expresses with invention of a claim 1 the relation of the aforementioned characteristic quantity for every smallness field when dividing into the small field of a predetermined number the field which is equivalent to a person's face in the characteristic quantity calculated for every smallness field the accuracy as a field equivalent to the face of the person of a candidate field — evaluating (for example, the characteristic quantity calculated for every smallness field agreeing with the aforementioned pattern, or the aforementioned evaluation being made high when the degree of coincidence is high) — Based on the internal structure of a person's face, the accuracy as a field equivalent to a person's face can be evaluated with a sufficient precision to a candidate field. And based on the evaluation result of a candidate field, the field equivalent to a person's face can be extracted with a sufficient precision.

[0014] By invention of a claim 1, since there is no need of performing repeat processing extracting the particular part inside a face or changing a threshold like binarization, while processing is simplified, it can also be prevented by the particular part inside a face not being extracted correctly that the precision of the evaluation to a candidate field falls. Therefore, according to invention of a claim 1, based on the internal structure of a person's face, simple processing can extract the field equivalent to a person's face with a sufficient precision.

[0015] in addition, when the direction of top and bottom of the picture which image data expresses is unknown About two or more mutually different directions, the division into the small field of the predetermined number of a candidate field, Characteristic quantity for every smallness field is calculated respectively (however, if the array and sense of each smallness field when seeing from each are carrying out abbreviation coincidence (the array and sense of each smallness field are related in each direction, and it is an abbreviation point symmetry)). Twist the need of dividing a small field each time, and evaluation of the accuracy as a field equivalent to a person's face to a candidate field is faced. When the characteristic quantity calculated for every smallness field among two or more directions agrees with the aforementioned pattern or the direction where the degree of coincidence is high exists, what is necessary is just made to make

the aforementioned evaluation high.

[0016] by the way, when the field equivalent to a person's face exists in a picture like taking a photograph so that the eye section on either side may exist in an each picture also in photography of the scene which the eye section of a person's face is seen from the transverse plane of a face, and exists in the abbreviation right-and-left symmetric position, and includes a person almost coming out, the field corresponding to ***** of a person's face exists in a picture by very high probability And in the field which corresponds on the eye section in a picture, or the outskirts of it, as explained also in advance, it has the feature that concentration or brightness changes frequently and a lot.

[0017] For this reason, it is made to divide a partition-pair elephant field in invention of a claim 1, in invention according to claim 2, so that it may be located in the small field where the fields equivalent to each eye section which constitutes ***** of a person's face differ. This is realizable by the thing of the arrangement in the size (surface ratio with a candidate field) of a small field, a number (predetermined number according to claim 1), and a candidate field for which it adjusts at least any they are.

[0018] When a candidate field is a field equivalent to a person's face, while the small field pair corresponding to ***** of a person's face exists in the small field of a predetermined number by very high probability, since the eye section exists in the characteristic position (seeing from the transverse plane of a face abbreviation right-and-left symmetric position), it can distinguish easily the small field pair presumed to correspond to *. Therefore, according to invention of a claim 2, accuracy as a field equivalent to a person's face to a candidate field can be evaluated with a more sufficient precision from the value of the characteristic quantity about the small field pair presumed to correspond to *.

[0019] In order to attain the 1st purpose of the above, moreover, the image-processing method concerning invention according to claim 3 Based on image data, considerable, then the candidate field presumed are extracted to the face of the person in the picture which this image data expresses. Based on the distribution of the concentration in the candidate field which carried out [aforementioned] extraction, or brightness, the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced is extracted. The position in a candidate field of the field which carried out [aforementioned] extraction, surface ratio with a candidate field, Based on at least one of the configurations of the histogram of concentration or brightness, the adjustment as a field equivalent to the aforementioned specific portion of the field which carried out [aforementioned] extraction is judged, and the accuracy as a field equivalent to the face of the person of the aforementioned candidate field is evaluated.

[0020] Like invention of a claim 1, based on image data, after extracting the candidate field presumed, in invention according to claim 3, considerable, then the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced are extracted based on the distribution of the concentration in the extracted candidate field, or brightness to the face of the person in the picture which this image data expresses.

[0021] Since there is irregularity in a person's face, in the subregion which is equivalent to the crevices (for example, **** etc.) of a person's face in the picture showing the scene which is illuminating a person's face on general lighting conditions, it becomes a concentration distribution or luminance distribution of a convex in the direction of high concentration (the low brightness direction) by making near the bottom of a crevice into the peak. In addition, although concentration or brightness is changing frequently and a lot within the subregion which corresponds on the eye section or the outskirts of it as explained previously, as the whole subregion equivalent to a crevice, it becomes the above concentration distributions (luminance distribution). On the other hand, in the subregion equivalent to the heights (for example, gena etc.) of a person's face, it becomes a concentration distribution or luminance distribution of a convex in the direction of low concentration (the high brightness direction) by making near the peak of heights into the peak.

[0022] The field which the pattern of concentration peculiar to the specific portion of the above persons' face or brightness has produced in invention of a claim 3, for example is extracted. It is based on at least one of the configurations of the histogram of the position in a candidate field of

the extracted field, surface ratio with a candidate field, concentration, or brightness. The adjustment as a field equivalent to the specific portion of the extracted field is judged, and since the accuracy as a field equivalent to the face of the person of a candidate field is evaluated, based on the internal structure of a person's face, the accuracy as a field equivalent to a person's face can be evaluated with a sufficient precision to a candidate field. And based on the evaluation result of a candidate field, the field equivalent to a person's face can be extracted with a sufficient precision.

[0023] Since a field is not divided in the position where the edge exists like the field division based on an edge, even if invention of a claim 3 is the case where the edge does not need to exist in the rim of the field equivalent to the specific portion of a person's face, and the edge does not exist in the rim of the aforementioned field, it can prevent that the precision of the evaluation to a candidate field falls. Moreover, since there is no need of performing repeat processing, like the field division based on binarization, changing a threshold, processing is simplified. Therefore, according to invention of a claim 3, based on the internal structure of a person's face, simple processing can extract the field equivalent to a person's face with a sufficient precision like invention of a claim 1.

[0024] In addition, in invention of a claim 3, although the pattern of the concentration in portions with a person's arbitrary face or brightness is employable as a pattern of concentration peculiar to the specific portion of a person's face, or brightness As indicated to the claim 4, the field which the pattern of the concentration of a convex or brightness has produced in the direction of high concentration peculiar to the eye section or the low brightness direction of a face of a person is extracted. [whether the adjustment as a field corresponding to the aforementioned **** of the extracted field is judged, and] Or the field which the pattern of the concentration of a convex or brightness has produced in the direction of low concentration peculiar to a gena or the high brightness direction of a face of a person is extracted, and it is desirable to judge the adjustment as a field corresponding to the aforementioned gena of the extracted field.

[0025] In addition, the judgment of the adjustment as a field equivalent to the eye section to the field which the pattern of the concentration of a convex or brightness has produced in the direction of high concentration, or the low brightness direction At least one of the configurations of the histogram of the position in a candidate field of the extracted field, surface ratio with a candidate field, concentration, or brightness It can carry out by collating with at least one of the configurations of the histogram of the concentration in the position of the eye section in a person's face, the surface ratio of a person's whole face and the eye section, and the eye section of a person's face, or brightness. Similarly also about the judgment of the adjustment as a field corresponding to the gena to the field which the pattern of the concentration of a convex or brightness has produced in the direction of low concentration, or the high brightness direction At least one of the configurations of the histogram of the position in a candidate field of the extracted field, surface ratio with a candidate field, concentration, or brightness It can carry out by collating with at least one of the configurations of the histogram of the concentration in the gena of the position the gena's in person's face, the surface ratio person's whole face and a gena's, and a person's face, or brightness.

[0026] It can judge with the eye section and the gena which were mentioned above having the high adjustment as a field corresponding to extracted **** or the gena of a field pair, if couple extraction of the field which the pattern of the field which the pattern of the concentration equivalent to the eye section or brightness has produced, the concentration equivalent to a gena, or brightness has produced is carried out at an abbreviation right-and-left symmetric position, since it sees from the transverse plane of a person's face and exists in the abbreviation right-and-left symmetric position. Therefore, accuracy as a field equivalent to a person's face to a candidate field can be evaluated with a more sufficient precision.

[0027] By the way, although a part for the background of high brightness in a picture might be incorrect-extracted with the field equivalent to the principal part when the picture of a processing object was a picture showing the scene in which the principal parts, such as a person, exist under the lighting conditions of a backlight, the invention-in-this-application person examined further the case which incorrect extraction produces as mentioned above. When the

background region of high brightness was divided into two or more fields in a picture top by the body with which the probability that incorrect extraction will arise when the background region of high brightness corresponding to the empty under the result, for example, a scene, etc. has accomplished the single field on the picture (not divided into two or more fields) exists before the background in a scene as opposed to a low's, the probability that incorrect extraction would arise found out the high thing.

[0028] In order to attain the 2nd purpose of the above based on the above, the image-processing method concerning invention according to claim 5 Based on image data, considerable, then the candidate field presumed are extracted to the principal part in the picture which this image data expresses. When the lightness of the candidate field which carried out

[aforementioned] extraction is beyond a predetermined value, the background candidate field where the difference of lightness with the aforementioned candidate field consists of the pixel of predetermined within the limits When the surface ratio to the aforementioned candidate field of the background candidate field which it searched within the limits of outside the aforementioned candidate field, and the aforementioned background candidate field was extracted, and was extracted is beyond a predetermined value, Or when the extracted background candidate field is unevenly distributed in the periphery section in a picture, evaluation of the accuracy as a field equivalent to the principal part to the aforementioned candidate field is made low.

[0029] In invention according to claim 5, considerable, then the candidate field presumed are first extracted to the principal part in the picture which this image data expresses based on image data. In addition, the principal part may be a field equivalent to a person's face, and may be a field equivalent to the body of others as the principal part. Next, when the lightness of the extracted candidate field is beyond a predetermined value, the background candidate field where the difference of lightness with a candidate field consists of the pixel of predetermined within the limits is searched within the limits of outside a candidate field. By this, when the extracted candidate field is a part of field which is equivalent to the background in a picture in fact, a part of other fields equivalent to the aforementioned background which exists in the range outside this candidate field will be extracted.

[0030] And the background candidate field where the difference of lightness with a candidate field consists of the pixel of predetermined within the limits is extracted, and when the background candidate field whose surface ratio to the candidate field of the extracted background candidate field is beyond a predetermined value and which was case [the field] or extracted is unevenly distributed in the periphery section in a picture, evaluation of the accuracy as a field equivalent to the principal part to a candidate field is made low. When the surface ratio to the candidate field of a background candidate field is beyond a predetermined value, or when the background candidate field is unevenly distributed in the periphery section in a picture (when the field of lightness of the same grade as a candidate field is distributed in a large area in a picture), a background candidate field and the candidate field extracted previously have high possibility of being a field equivalent to a background. Therefore, the field equivalent to the background in a picture can suppress being incorrect-extracted as a field equivalent to the principal part by making low evaluation of the accuracy as a field which is equivalent to the principal part to a candidate field as mentioned above.

[0031] moreover, by the picture as which the principal part expresses the scene currently illuminated by the stroboscope etc. Since the area of this background candidate field is small though the field (background candidate field) of lightness equivalent to the principal part exists in a picture, and possibility of being unevenly distributed in the periphery section in a picture is low According to invention of a claim 5, in the above pictures, considerable, then the evaluation of the accuracy as a field equivalent to the principal part to the candidate field presumed can prevent a bird clapper low unfairly to the principal part.

[0032] That the image processing system concerning invention according to claim 6 is equivalent to the face of the person in the picture which this image data expresses based on image data, then 1st extraction means to extract the candidate field presumed, While dividing into the small field of a predetermined number the candidate field extracted by the extraction means of the above 1st An operation means to calculate the characteristic quantity relevant to the

concentration in a small field or the frequency of change of brightness, and the size of change for every smallness field, By collating with the pattern showing the relation of the aforementioned characteristic quantity for every smallness field when dividing into the small field of the aforementioned predetermined number the field which is equivalent to a person's face in the characteristic quantity calculated for every aforementioned smallness field by the aforementioned operation means Since it is constituted including an evaluation means to evaluate the accuracy as a field equivalent to the face of the person of the aforementioned candidate field, based on the internal structure of a person's face, simple processing can extract the field equivalent to a person's face with a sufficient precision like invention of a claim 1.

[0033] That the image processing system concerning invention according to claim 7 is equivalent to the face of the person in the picture which this image data expresses based on image data, then 1st extraction means to extract the candidate field presumed, The 2nd extraction means which extracts the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced based on the distribution of the concentration in the candidate field extracted by the extraction means of the above 1st, or brightness, The position in a candidate field of the field which carried out [aforementioned] extraction, surface ratio with a candidate field, An evaluation means to evaluate the accuracy as a field which judges the adjustment as a field equivalent to the aforementioned specific portion of the field which carried out [aforementioned] extraction based on at least one of the configurations of the histogram of concentration or brightness, and is equivalent to the face of the person of the aforementioned candidate field, Since it consists of *****, based on the internal structure of a person's face, simple processing can extract the field equivalent to a person's face with a sufficient precision like invention of a claim 3.

[0034] While dividing that the record medium concerning invention according to claim 8 is equivalent to the face of the person in the picture which this image data expresses based on image data then the 1st step which extracts the candidate field presumed, and the candidate field which carried out [aforementioned] extraction into the small field of a predetermined number The 2nd step which calculates the characteristic quantity relevant to the concentration in a small field or the frequency of change of brightness, and the size of change for every smallness field, By collating with the pattern showing the relation of the aforementioned characteristic quantity for every smallness field when dividing into the small field of the aforementioned predetermined number the field which is equivalent to a person's face in the characteristic quantity calculated for every aforementioned smallness field The program for making a computer perform processing containing the 3rd step which evaluates the accuracy as a field equivalent to the face of the person of the aforementioned candidate field is recorded.

[0035] The processing which contains the 1st above-mentioned step or the 3rd step in the record medium concerning invention according to claim 8, Namely, since the program for making invention of a claim 1 perform processing concerning the image-processing method of a publication to a computer is recorded By reading and executing the program to which the computer is recorded on the aforementioned record medium, things can perform extracting the field equivalent to a person's face with a sufficient precision by simple processing like invention of a claim 1 based on the internal structure of a person's face.

[0036] That the record medium concerning invention according to claim 9 is equivalent to the face of the person in the picture which this image data expresses based on image data, then the 1st step which extracts the candidate field presumed, The 2nd step which extracts the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced based on the distribution of the concentration in the candidate field which carried out [aforementioned] extraction, or brightness, The position in a candidate field of the field which carried out [aforementioned] extraction, surface ratio with a candidate field, Based on at least one of the configurations of the histogram of concentration or brightness, the adjustment as a field equivalent to the aforementioned specific portion of the field which carried out [aforementioned] extraction is judged. The program for making a computer perform processing containing the 3rd step which evaluates the accuracy as a field equivalent to the face of the person of the aforementioned candidate field is recorded.

[0037] The processing which contains the 1st above-mentioned step or the 3rd step in the record medium concerning invention according to claim 9, Namely, since the program for making invention of a claim 3 perform processing concerning the image-processing method of a publication to a computer is recorded By reading and executing the program to which the computer is recorded on the aforementioned record medium, simple processing can extract the field equivalent to a person's face with a sufficient precision like invention of a claim 3 based on the internal structure of a person's face.

[0038]

[Embodiments of the Invention] Hereafter, with reference to a drawing, an example of the operation gestalt of this invention is explained in detail.

[0039] The [1st operation gestalt] The image processing system 10 with which this invention was applied is shown in drawing 1 . A scanner 12, an image processing system 14, and a printer 16 are connected in series, and the image processing system 10 is constituted.

[0040] A scanner 12 is a film picture (after photoing a photographic subject) currently recorded on photosensitive material (a photographic film is only called below), such as a photographic film (for example, a negative film and a reversal film). The negative picture or positive picture visualized by a development being carried out is read. The light with which the image data obtained by this reading is outputted, it was injected from the light source 20, and quantity of light unevenness was reduced by the optical diffusion box 22 The photographic films 26 set to the tape carrier package 24, such as a negative film and a reversal film, irradiate. It is constituted so that image formation of the light which penetrated the photographic film 26 may be carried out through a lens 28 on the light-receiving side of the CCD sensor 30 (you may be a line sensor even if it is an area sensor).

[0041] A tape carrier package 24 conveys a photographic film 26 so that the part where the film picture on a photographic film 26 is recorded may be located in order on the optical axis of the injection light from the light source 20. The film picture currently recorded on the photographic film 26 is read in order by the CCD sensor 30 by this, and the signal corresponding to a film picture is outputted from the CCD sensor 30. The signal outputted from the CCD sensor 30 is changed into digital image data by A/D converter 32, and is inputted into an image processing system 14.

[0042] The line scanner amendment section 36 of an image processing system 14 The dark amendment which reduces the dark output level of the cell which corresponds for every pixel from the inputted scanning data (data of R, G, and B inputted from a scanner 12), The concentration conversion which carries out logarithmic transformation of the data which performed dark amendment to the data showing a concentration value, The quantity of light unevenness of the light which illuminates a photographic film 26 is embraced. the data after concentration conversion An amendment shading compensation, Each processing of the defective pixel amendment which interpolates the data of a cell (the so-called defective pixel) with which the signal corresponding to the amount of incident lights is not outputted among the data which performed this shading compensation from the data of a surrounding pixel, and newly generates them is performed in order. The outgoing end of the line scanner amendment section 36 is connected to the input edge of I/O controller 38, and the data with which each aforementioned processing was performed in the line scanner amendment section 36 are inputted into I/O controller 38 as scanning data.

[0043] The input edge of I/O controller 38 is connected also to the data output edge of an image processor 40, and the image data to which the image processing (it mentions later for details) was performed is inputted from an image processor 40. Moreover, the input edge of I/O controller 38 is connected also to the personal computer 42. The personal computer 42 is equipped with the expansion slot (illustration abbreviation), and the communication controller for communicating with the driver (illustration abbreviation) which performs read-out/writing of data to information-storage media, such as a digital camera card in which image data was written by the digital still camera etc., and CD-R in which image data was written by the CD-R write-in equipment which is not illustrated, and other information management systems is connected to this expansion slot. When file image data (image data read from the digital camera card or CD-R

or image data which received from other information management systems) is inputted from the exterior through an expansion slot, the inputted file image data is inputted into I/O controller 38. [0044] It connects with the data input edge of an image processor 40, the auto setup engine 44, and the personal computer 42 respectively, and the outgoing end of I/O controller 38 is further connected to the printer 16 through the I/F circuit 54. I/O controller 38 outputs the inputted image data to each aforementioned device connected to the outgoing end alternatively.

[0045] This operation form performs two reading in different resolution in a scanner 12 to each film picture currently recorded on the photographic film 26. Reading of the whole surface of a photographic film 26 is performed on the reading conditions (quantity of light for every wavelength region of R, G, and B of the light which irradiates a photographic film 26, charge-storage time of the CCD sensor 30) comparatively determined that the saturation of a stored charge will not arise by the CCD sensor 30 by reading (henceforth a press can) by the low resolution when [1st] the concentration of a film picture was very low (for example, negative picture of the exposure undershirt in a negative film). The data (press can data) obtained by this press can are inputted into the auto setup engine 44 from I/O controller 38.

[0046] The auto setup engine 44 is equipped with CPU46, RAM48 (for example, DRAM), ROM50 (for example, ROM which can rewrite the content of storage), and input/output port 52, and these are mutually connected through a bus and it is constituted. The auto setup engine 44 judges the coma position of a film picture based on the press can data inputted from I/O controller 38, and extracts the data (press can image data) corresponding to the film image recording field on a photographic film 26. Moreover, based on press can image data, while judging the size of a film picture, picture characteristic quantity, such as concentration, is calculated, and the reading conditions at the time of a scanner 12 performing reading (henceforth a fine scan) for the second time by high resolution comparatively are determined to the photographic film 26 which performed the press can. And a coma position and reading conditions are outputted to a scanner 12.

[0047] Moreover, the auto setup engine 44 is based on press can image data (or low-resolution-ized file image data). Picture characteristic quantity including extraction of the principal part in a picture (for example, field equivalent to a person's face (face field)) is calculated. A scanner 12 determines automatically the processing conditions of various kinds of image processings over the fine scan image data (or file image data) obtained by performing a fine scan according to an operation (setup operation), and outputs the determined processing conditions to an image processor 40.

[0048] The display, the keyboard, and the mouse are connected to the personal computer 42 (all are illustration ellipses). A personal computer 42 incorporates the processing conditions of the image processing for which it opted with the auto setup engine 44, performs an image processing equivalent to the image processing performed by the image processor 40 for a high-resolution image data to low resolution picture data based on the incorporated processing conditions, and generates simulation image data while it incorporates the image data of a low resolution from the auto setup engine 44.

[0049] And the generated simulation image data is changed into the signal for displaying a picture on a display, and a simulation picture is displayed on a display based on this signal. Moreover, if the information which official approval of quality of image etc. is performed by the operator, and directs correction of processing conditions as an official approval result to the displayed simulation picture is inputted through a keyboard, this information will be outputted to the auto setup engine 44. Thereby, with the auto setup engine 44, processing of the re-operation of the processing conditions of an image processing etc. is performed.

[0050] The fine scan image data (or file image data of high resolution) inputted into I/O controller 38 by performing a fine scan to a film picture with a scanner 12 on the other hand is inputted into an image processor 40 from I/O controller 38. An image processor 40 is respectively equipped with the image-processing circuit which performs various kinds of image processings, such as hyper-sharpness processing in which sharpness is emphasized, suppressing the shape of a color and concentration amendment processing including a gray scale conversion or color conversion, pixel density transform processing, the hyper-tone processing that

compresses the gradation of the extremely-low-frequency brightness component of a picture, and a grain, and performs various image processings to the inputted image data according to the processing conditions determined and notified for every picture with the auto setup engine 44.

[0051] As an image processing which can be performed by the image processor 40 In addition to the above, for example, the whole picture, the sharpness amendment which receives in part (for example, field equivalent to a person's face), or soft focus processing, the image processing (the image processing which makes a monotone to an output picture --) which changes a drawing tone intentionally The image processing which makes a portrait tone to an output picture, the image processing which makes a sepia tone to an output picture, the image processing (for example, the image processing for making a thin figure to the person who exists in a subject-copy image on the main picture --) which processes a picture As opposed to the image processing which corrects bloodshot eyes, and the picture photoed by LF (disposable camera) The geometric distortion of the picture resulting from the distortion aberration of the lens of LF, and the chromatic aberration of magnification, The lightness fall of the periphery section of the picture which originates a color gap in limb darkening of amendment LF aberration amendment processing and the lens of LF Amendment limb-darkening amendment processing, LF aberration amendment processing of amendment various kinds etc. is mentioned in deterioration of the quality of image of the output picture which originates the fall of the sharpness of the picture resulting from the property of the lens of LF in the property of the lens of LF like amendment focus dotage amendment processing.

[0052] When using for record of the picture to printing paper the image data to which the image processing was performed by the image processor 40, the image data to which the image processing was performed is outputted to a printer 16 as image data for record through the I/F circuit 54 from I/O controller 38 by the image processor 40. Moreover, when outputting to the exterior by making the image data after an image processing into an image file, image data is outputted to a personal computer 42 from I/O controller 38. This outputs the image data inputted from I/O controller 38 as an object for the output to the exterior to the exteriors (the aforementioned driver, communication controller, etc.) as an image file through an expansion slot in a personal computer 42.

[0053] The printer 16 is equipped with the laser driver 62 which controls the operation of an image memory 58, the laser light source 60 of R, G, and B, and this laser light source 60. Once the image data for record inputted from the image processing system 14 is memorized by the image memory 58, it is read, and it is used for the modulation of the laser beam of R, G, and B which are injected from a laser light source 60. The laser beam injected from the laser light source 60 has a printing paper 68 top scanned through the polygon mirror 64 and the ftheta lens 66, and exposure record of the picture is carried out at printing paper 68. The printing paper 68 in which exposure record of the picture was carried out is sent to the processor section 18, and each processing of the color development, bleaching fixing, rinsing, and dryness is performed.

Thereby, the picture by which exposure record was carried out is visualized by printing paper 68.

[0054] Next, the face field extraction and concentration data processing performed after inputting press can data into an image processing system 14 and processing logging of the image data from press can data etc. in the auto setup engine 44 as an operation of this operation form from a scanner 12 are explained.

[0055] The face field extraction and concentration data processing concerning a **** 1 operation form are the processings to which the image-processing method concerning invention of a claim 1 was applied, and is realized by performing face field extraction and a concentration amendment program by CPU46 of the auto setup engine 44. The information-storage medium 72 (refer to drawing 1) memorizes at the beginning with the program for face field extraction and a concentration amendment program performing other processings by CPU46. In addition, although the information-storage medium 72 is shown as a floppy disk, other information-storage media, such as CD-ROM and memory card, may constitute from drawing 1 . If the information read-out equipment (illustration abbreviation) connected to the personal computer 42 is loaded with the information-storage medium 72 and import (installation) of the program from the information-storage medium 72 to an image processing system 14 is directed, with information read-out

equipment, face field extraction, a concentration amendment program, etc. will be read from the information-storage medium 72, and ROM50 which can rewrite the contents of storage will memorize.

[0056] And if the timing which should perform face field extraction and concentration amendment processing comes, face field extraction and a concentration amendment program will be read from ROM50, and face field extraction and a concentration amendment program will be performed by CPU46. Thereby, the auto setup engine 44 functions as an image processing system concerning invention of a claim 6. Thus, the information-storage medium 72 which has memorized face field extraction, the concentration amendment program, etc. is equivalent to the record medium according to claim 8.

[0057] Hereafter, face field extraction and concentration amendment processing are explained with reference to the flow chart of drawing 2. Equivalent to the face of the person in a picture as the principal part in the picture which image data expresses with Step 100 based on the image data of a processing object, then the field presumed (face candidate field extraction processing in which a face candidate field is extracted is performed.) As a sampling procedure for performing this face candidate field extraction processing Equivalent to the face of the person in a picture, then the face candidate field sampling procedure which judges the field presumed and extracts this field as a face candidate field, Considerable, then the background removal method which judges the field (background region) presumed and extracts fields other than a background region as a face candidate field are in the background in a picture. specifically Inside [it is the following face candidate sampling procedures better known than before and a background removal method] can adopt at least any they are, and face candidate field extraction processing can be performed.

[0058] [Example 1 of a face candidate field sampling procedure] While dividing a picture into much point of measurement, each point of measurement R, It is based on the data (image data) obtained by decomposing into three colors of G and B. it judges whether each point of measurement is contained within the limits of flesh color on the color coordinate, and the field where the cluster (group) of the point of measurement judged to be within the limits of flesh color exists is extracted as a face candidate field (a Provisional-Publication-No. 52 No. -156624 official report --) Provisional Publication No. 52 No. -156625 official report, JP,53-12330,A, Provisional Publication No. 53 No. -145620 official report, Provisional Publication No. 53 No. -145621 official report, Provisional Publication No. References, such as 53 No. -145622 official report.

[0059] [Example 2 of a face candidate field sampling procedure] It asks for the histogram about a hue value (and saturation value) based on the aforementioned image data. It divides into the group corresponding to the mountain which judged to any of the mountain which divided the histogram for which it asked for every mountain, and each point of measurement divided it would belong, and divided each point of measurement. A picture is divided into two or more fields for every group, the field which is equivalent to a person's face among two or more of these fields is presumed, and the presumed field is extracted as a face candidate field (refer to JP,4-346333,A).

[0060] It searches for any one of the configuration patterns (for example, configuration pattern: showing the profile of a head, the profile of a face, etc. -- unnecessary, since it uses by the processing later mentioned about the internal structure of a face here) peculiar to each part of the person who exists in a picture based on the aforementioned image data. [Example 3 of a face candidate field sampling procedure] -- According to the physical relationship of the predetermined portion the person's [whom the size of the detected configuration pattern, the sense, and the detected configuration pattern express], and a person's face, considerable, then the field presumed are set as a person's face. Moreover, it looks for other different configuration patterns from the detected configuration pattern, the adjustment as a person's face of the field set up previously is searched for, and a face candidate field is extracted (references, such as JP,8-122944,A, JP,8-183925,A, and JP,9-138471,A).

[0061] [Example 4 of a face candidate field sampling procedure] While calculating the variation of the concentration in each part in a picture, or brightness for every direction based on the

• aforementioned image data and setting up a reference point The search direction pattern showing the change direction of the concentration or the brightness in each part of this search range and search within the limits for which it should search is set up to this reference point according to the profile configuration of a face field. The variation of the concentration which met in the direction which exists in aforementioned search within the limits, and the aforementioned search direction pattern expresses, or brightness searches the part beyond a predetermined value. By repeating setting up this part as a next reference point, when the part with which are satisfied of search conditions is detected, and extracting the line which connects two or more places of the picture set up in order as the aforementioned reference point, and changes as a border line showing the profile of a face field A face candidate field is extracted (references, such as JP,9-138471,A).

[0062] [Example 1 of a background removal method] It is based on the aforementioned image data, each point of measurement It judges whether it is contained within the limits of the specific colors (for example, blue of empty or the sea, grass, wooden green, etc.) which belong to a background clearly on a color coordinate. The field where the cluster (group) of the point of measurement judged to be specific aforementioned color within the limits exists is judged to be a background region, it removes, and the field which remained is extracted as a non-background region (field where possibility that the field equivalent to a person's face is included is high : also this face candidate field of this invention).

[0063] [Example 2 of a background removal method] after dividing a picture as well as Example 2 of a previous principal part sampling procedure into two or more fields based on the aforementioned image data the characteristic quantity (the ratio for the bay contained in a profile —) as a field which is equivalent to a background for every field The degree of axial symmetry, the number of irregularity, ratio contact with a picture rim, the concentration contrast in a field, Ask for the existence of the change pattern of the concentration in a field etc., and the field which each field judged whether it was a background region based on the calculated characteristic quantity, and was judged to be a background is removed. The field which remained is extracted as a non-background region (face candidate field) (references, such as JP,8-122944,A and JP,8-183925,A).

[0064] In addition, the above-mentioned sampling procedure is a mere example, and from a picture, if it is the sampling procedure which extracts the field presumed, it cannot be overemphasized equivalent to a person's face, then that it can apply no matter it may be what method. Moreover, at Step 100, respectively with the application of two or more sorts of sampling procedures, face candidate field extraction processing may be performed two or more times, processing conditions may be respectively changed by the sampling procedure of a single kind, and face candidate field extraction processing may be performed two or more times. In addition, Step 100 corresponds to the 1st extraction means given in a claim 6 (and claim 7).

[0065] It judges whether there is any top-and-bottom information which expresses with the following step 102 the direction of top and bottom of the picture which the image data of a processing object expresses. For example, when the image data of a processing object is image data obtained by reading the picture currently recorded on the photographic film in which the magnetic layer was formed, the top-and-bottom information by which magnetic recording was carried out at the time of photography record of a picture is included in many cases in the various information by which magnetic recording is carried out to the magnetic layer. In such a case, by reading magnetically the information by which magnetic recording is carried out to the magnetic layer, top-and-bottom information is acquired, the judgment of Step 102 is affirmed, and it shifts to Step 104.

[0066] At Step 104, the data of a single face candidate field are incorporated out of the face candidate field extracted by face candidate field extraction processing of Step 100, and in the following step 106, the face candidate field of the processing object which incorporated data is divided into the block of a predetermined number, as shown in drawing 4 (A) as an example. By drawing 4 (A), the square field (field equivalent to the dashed line of the outermost edge of drawing 4 (A)) normalized so that a length of one side might be in agreement with the longitudinal direction (usually direction of top and bottom of picture) length of a face candidate field is used

as an example. The face candidate field is divided in accordance with the parting line (line shown with a dashed line) when dividing this square field into the block (small field given in claim 1 grade) of 5x5 squares.

[0067] In addition, the field equivalent to each eye section which as for the division pattern (the configuration and arrangement of the number of partitions to a block or a block) of the face candidate field shown in drawing 4 (A) constitutes ***** of a person's face so that clearly from drawing is appointed at being located in a mutually different block. Therefore, dividing a face candidate field according to the division pattern shown in drawing 4 (A) corresponds to division according to claim 2. Moreover, a division pattern is not limited above and the configuration and arrangement of the number of blocks and each block can be suitably changed within limits which do not deviate from this invention.

[0068] Edge on-the-strength integrated value is calculated in calculating and integrating the edge intensity (concentration variation) about the predetermined direction according to the direction of top and bottom which top-and-bottom information expresses with Step 108 for every block of a face candidate field. In addition, edge on-the-strength integrated value corresponds to "the characteristic quantity relevant to the concentration in a smallness field or the frequency of change of brightness, and the size of change" concerning this invention, and Step 108 corresponds to the operation means according to claim 6. With the ***** 1 operation form, in order to extract a face field using the concentration in the field equivalent to the eye section of a person's face changing frequently and a lot, the direction where the frequency of change of the concentration in the field equivalent to the eye section and the size of change become large notably, i.e., the direction which is in agreement in the direction of top and bottom, is made into the predetermined direction according to the direction of top and bottom.

[0069] the differentiation filter for calculating the concentration change value which met in the direction (a total of eight direction: — drawing 5 shows as eight arrows with which directions differ) which goes to eight pixels which exist near this specific pixel from a specific pixel respectively is shown in drawing 5 Among the eight above-mentioned differentiation filters, the operation of the edge on-the-strength integrated value for every block chooses the differentiation filter corresponding to the predetermined direction according to the direction of top and bottom, can calculate respectively the concentration variation (edge intensity) which met in the aforementioned predetermined direction about all the pixels in a face candidate field using the selected differentiation filter, and can obtain it by integrating the result of an operation for every block.

[0070] At the following step 110, in order to evaluate the accuracy as a field which is equivalent to a person's face to a face candidate field in the edge on-the-strength integrated value for every block calculated at Step 108, it collates with the edge on-the-strength integrated value (standard value) for every block in the pattern for matching set up beforehand, and it asks for the degree of coincidence with the pattern for matching. The pattern for matching divides the field (face field) equivalent to the face of the person in a picture like the division pattern to a face candidate field (refer to drawing 4 (B)). It performs calculating edge on-the-strength integrated value for every block about many face fields of many pictures, and is set by setting up the average of the edge on-the-strength integrated value for every block for which it asked respectively about many face fields of many pictures as a standard value to each block.

[0071] By the above, the standard value of the edge on-the-strength integrated value for every block in the pattern for matching About the block (see drawing 4 (A)) of the couple equivalent to the eye section of the couple a person's face It becomes a low value, as it described in drawing 4 (B) about the block (see drawing 4 (A)) which is equivalent to the gena and glabella of a couple among a person's faces, while becoming a very high value, as described in drawing 4 (B). It becomes a value reflecting the frequency of change of the concentration (or brightness) in each part of a person's face, and the size of change.

[0072] With a ***** 1 operation gestalt, it collates by comparing the operation value of edge on-the-strength integrated value with the standard value of the edge on-the-strength integrated value set up by the pattern for matching about five blocks (block surrounded and shown in drawing 4 (B) as a solid line) which are equivalent to the eye section of the couple of a person's

faces, the gena of a couple, and a glabella among 5x5 blocks. And the operation and setup of it are done, using as the degree of coincidence physical quantity (for example, ratio of the deflection of the operation value of the edge on-the-strength integrated value of each block when being based on the deflection of the standard value of the edge on-the-strength integrated value of each block etc.) from which a value changes according to the difference in the operation value over the standard value of the edge on-the-strength integrated value about five aforementioned blocks. In addition, edge on-the-strength integrated value of all blocks is compared and collated, and you may make it set up the degree of coincidence.

[0073] At Step 112, it judges whether Steps 104-110 were processed to all the face candidate fields extracted at Step 100. Steps 104-112 are repeated until it returns to Step 104 and the aforementioned judgment is affirmed, when a judgment is denied. By this, the degree of coincidence with the pattern for matching will be respectively calculated and set up to all face candidate fields. And if the judgment of Step 112 is affirmed, it will shift to Step 142.

[0074] On the other hand, when there is no top-and-bottom information, the judgment of Step 102 is denied and it shifts to Step 120, and after incorporating the data of a single face candidate field out of the face candidate field extracted by face candidate field extraction processing of Step 100, in the following step 122, the face candidate field which incorporated data is divided into the block of a predetermined number like previous Step 106. This step 122 also corresponds to division according to claim 2. In Step 124, since the direction of top and bottom of the picture of a processing object is unknown, the edge on-the-strength integrated value about the 1st - the 4th direction is respectively calculated in calculating and integrating edge intensity (concentration variation) about four predetermined directions (the 1st direction - the 4th direction being called for convenience hereafter) parallel to the four sides which accomplish the rim of the picture of a processing object. This step 124 also corresponds to the operation means according to claim 6.

[0075] At Step 126, 1 is substituted for Variable n, in the following step 128, the n-th direction is assumed to be the direction of top and bottom for the edge on-the-strength integrated value for every block about the n-th direction (it is the 1st direction in this case), it collates with the pattern for matching, and the degree of coincidence is calculated like previous Step 110. At Step 130, when it judges whether the value of Variable n was set to 4 and a judgment is denied, only 1 increments the value of Variable n at Step 132, and it returns to Step 128. By this, at Step 128, the 1st - the 4th direction will be respectively assumed to be the directions of top and bottom, and the degree of coincidence with the pattern for matching will calculate respectively.

[0076] in addition, the direction which calculates the degree of coincidence -- the 1- it is not limited in the four directions of the 4th, and you may make it calculate the degree of coincidence about eight directions shown in drawing 5 by eight arrows (the same is said of the 2nd operation form mentioned later)

[0077] If the degree of coincidence calculates respectively about each direction, the judgment of Step 130 will be affirmed, it will shift to Step 134, and the direction where the degree of coincidence became the maximum among the 1st - the 4th direction will be memorized. At the following step 136, it judges whether it processed to all face candidate fields. When a judgment is denied, it returns to Step 120, and Steps 120-136 are repeated. Thereby, the degree of coincidence with the pattern for matching is respectively calculated and set up about the 1st - the 4th direction to all face candidate fields.

[0078] If the judgment of Step 136 is affirmed, it will shift to Step 138, and the degree of coincidence respectively memorized about each face candidate field at previous Step 134 judges the direction of top and bottom of a picture based on the greatest direction. This judgment calculates the number of the face candidate fields whose directions of the degree maximum of coincidence correspond for every direction, and you may make it judge the direction of the most numerous [number / of face candidate fields] to be the direction of top and bottom. Moreover, it performs adding weight mark in each direction to all face candidate fields so that weight mark may become high, and you may make it the integrated value of the weight mark added to each direction judge the greatest direction based on the degree of coincidence about the 1st of a specific face candidate field - the 4th direction to be the direction of top and bottom as the

value of the degree of coincidence becomes high.

[0079] If the direction of top and bottom is judged as mentioned above, at the following step 140, the degree of coincidence for every face candidate field about the predetermined direction corresponding to the judged direction of top and bottom will be set as each face candidate field, and it will shift to Step 142.

[0080] At Step 142, weight mark are set up to each face candidate field according to the degree of coincidence set up to each face candidate field. In addition, these weight mark correspond to the evaluation value which evaluates the accuracy as a field equivalent to the face of the person of a face candidate field, and Step 142 corresponds to the evaluation means according to claim 6 with Steps 110, 128, and 140.

[0081] Weight mark can be set up using the map on which the transfer characteristic was set that the degree of coincidence follows on increasing and the weight mark P become high by changing the degree of coincidence into the weight mark P using this map, as shown in drawing 6 (A) as an example. In addition, the transfer characteristic shown in drawing 6 (A) may be a mere example, for example, although the insensible field where the weight mark P do not change to change of the degree of coincidence exists in the transfer characteristic shown in drawing 6 (A), you may be the transfer characteristic (refer to drawing 6 (B) as an example) without such an insensible field. Moreover, what is necessary is just the transfer characteristic which may use the transfer characteristic from which the weight mark P change nonlinear to change of the degree of coincidence, the degree of coincidence follows on becoming large, and the weight mark P increase.

[0082] Collate with the pattern for matching which expresses above the edge on-the-strength integrated value [in / an actual face field / for the edge on-the-strength integrated value calculated for every block] for every block, and it asks for the degree of coincidence. Since the weight mark equivalent to the evaluation result of the accuracy as a face field to a face candidate field are set up based on the aforementioned degree of coincidence, based on the internal structure of a person's face, the accuracy as a face field can be evaluated with a sufficient precision to each face candidate field. Moreover, since there is no need of performing repeat processing extracting the particular part inside a face or changing a threshold like binarization, while processing is simplified, it can also be prevented by the particular part inside a face not being extracted correctly that the precision of the evaluation to a face candidate field falls.

[0083] Background region judging processing is performed at the following step 144. This background region judging processing is explained with reference to the flow chart of drawing 3 . The data of the single face candidate field for a judgment are incorporated out of the face candidate field extracted by face candidate field extraction processing (Step 100) at Step 160, and the lightness M of the face candidate field for a judgment is calculated at the following step 162. In addition, Lightness M may be the average (absolute value) of the lightness in the face candidate field for a judgment, and may be the ratio (relative value) of the average lightness in the face candidate field for [to the full-screen average of the lightness of a processing-object picture] a judgment.

[0084] At Step 164, the lightness searched for at Step 162 judges whether it is beyond a predetermined value. Although it shifts to Step 176, without processing in any way when the aforementioned judgment is denied, when the aforementioned judgment is affirmed, it shifts to Step 166, and the field (background candidate field) where the difference of lightness with a face candidate field consists only of the pixel of predetermined within the limits is extracted from the range which corresponds outside the face candidate field for a judgment among processing-object pictures. In addition, Step 166 corresponds to the thing [carrying out "searching the background candidate field where the difference of lightness with a candidate field consists of the pixel of predetermined within the limits"] according to claim 5.

[0085] And at the following step 168, the gross area of the extracted background candidate field is calculated, and the ratio (surface ratio) of the gross area of a background candidate field to the area of the face candidate field for a judgment is calculated. Moreover, at the following step 170, the maldistribution degree to the picture periphery section of the extracted background

candidate field is calculated. As this maldistribution degree, the value which integrated the distance of each pixel which constitutes the screen center and background candidate field of a processing-object picture, and ** can be used, for example.

[0086] At Step 172, the surface ratio of a background candidate field judges whether the maldistribution degree of that it is beyond the 1st predetermined value and a background candidate field satisfies at least one side of ** for whether it is beyond the 2nd predetermined value. For example, as the picture of a processing object shows drawing 7, by high lightness, a background region with a large area (field which is equivalent to empty in drawing 7) is divided into two or more fields by the field equivalent to the body (drawing 7 tree) which exists to the front, and when it is a picture, as hatching shows to drawing 7, a part of background region may be incorrect-extracted as a face candidate field.

[0087] However, by such picture, this face candidate field and the field of the same lightness exist in the circumference of the incorrect-extracted face candidate field, and when it is many, it is unevenly distributed [this field] in the picture periphery section while being extensive area. Therefore, when the judgment of Step 172 is affirmed, it is presumed that the face candidate field for a judgment has high possibility of being a part of background region. For this reason, although it shifts to Step 176, without processing in any way when the judgment of Step 172 is denied, when a judgment is affirmed, it shifts to Step 174, and according to the surface ratio and the maldistribution degree of a background candidate field, weight mark are corrected so that the weight mark to the face candidate field for a judgment may fall.

[0088] Correction of these weight mark P can be made using the map shown in drawing 8 (A). It has the transfer characteristic expressed in a zero by the straight line with a passage and an inclination smaller than 1 on the coordinate to which this map took weight mark (beginning) along the horizontal axis the first stage, and took the weight mark after correction along the vertical axis. By changing the weight mark P using the above maps (downward revision), the face candidate field for [with high possibility that it is not a face field in fact] a judgment can make small the grade of a bad influence exerted on after treatment. In addition, correction of the weight mark in Step 174 corresponds to the thing according to claim 5 "for which evaluation of the accuracy as a field equivalent to the principal part to a candidate field is made low."

[0089] At the following step 176, it judges whether it processed to all face candidate fields. When a judgment is denied, it returns to Step 160, and Steps 160-176 are repeated to all face candidate fields. If the judgment of Step 176 is affirmed, background region judging processing will be ended and it will shift to Step 146 of the flow chart of drawing 2. In addition, the weight mark P finally set up to each face candidate field through the processing mentioned above correspond to the evaluation value showing the last evaluation of the accuracy as a field equivalent to a person's face to each face candidate field.

[0090] Step 146 compares respectively the weight mark P of each face candidate field with the threshold THF for a face field judging, and the weight mark P are Threshold THF. It is extracted, using the above face candidate field as a face field (selection). In addition, the face candidate field where the degree of coincidence with the pattern for matching is high, and the accuracy which is a face field is high since a background candidate field passes and the final weight mark P become high about the face candidate field where surface ratio and a maldistribution degree are low will be extracted as a face field.

[0091] Moreover, at the following step 148, according to the following (1) formula or (2) formulas, the face field concentration M_{face} of the picture of a processing object is calculated, and face field extraction and concentration data processing are ended.

[0092]

[Equation 1]

$$M_{face} = \sum_{i=1}^N (M_i \cdot P_i) / \sum_{i=1}^N P_i, \quad \dots (1)$$

$$M_{face} = \sum_{i=1}^N (M_i \cdot P_i \cdot S_i) / \sum_{i=1}^N (P_i \cdot S_i) \quad \dots (2)$$

However, the sign for i discriminating each face candidate field and N are the total of a face

candidate field, and M_i . The concentration of the face candidate field i , and P_i The weight mark of the face candidate field i , and S_i It is the area of the face candidate field i .

[0093] (1) The face field concentration M_{face} is the weighted average efficiency of the concentration M of each face candidate field, by (1) formula, is carrying out weighting of each face candidate field based on the weight mark P of each face candidate field, and is carrying out weighting of each face candidate field based on the weight mark P and area S in (2) formulas so that more clearly than a formula and (2) formulas.

[0094] If the above-mentioned face field extraction and concentration data processing are performed, although the auto setup engine 44 calculates further the processing conditions of various kinds of image processings performed by the image processor 40, the processing result of face field extraction and concentration data processing will be used for the operation of the processing conditions of a part of image processings. For example, the face field extracted at previous Step 146 is used for the operation of the image processings (for example, sharpness amendment, bloodshot-eyes amendment, etc. to a face field) only for the face field performed by the image processor 40, or its part, and processing conditions are set up so that the aforementioned image processing may be performed only for a face field. Moreover, processing conditions, such as concentration amendment conditions, calculate the face field concentration M_{face} calculated at previous Step 148 so that it may be used for the image processings (for example, a color, concentration amendment, etc.) for the whole picture performed by the image processor 40, for example, the face field concentration M_{face} may turn into predetermined concentration.

[0095] Since extraction of a face field and face field concentration M_{face} are performed using the weight mark set up based on the degree of coincidence with the pattern for matching as explained also in advance Though the face candidate field which is not a face field in fact is intermingled by incorrect extraction in the face candidate field extracted by face candidate field extraction processing While the probability that the face candidate field which is not a face field in fact will be extracted as a face field is reduced sharply, it can also be prevented that face field concentration changes with the concentration of the face candidate field which is not a face field in fact sharply. Therefore, proper processing conditions are acquired also to each image processing which processing conditions calculate using the extraction result of a face field, or the face field concentration M_{face} , and a processing result proper also about each image processing performed by the image processor 40 for fine scan image data is obtained.

[0096] The [2nd operation gestalt] The 2nd operation gestalt of this invention is explained below. In addition, since a **** 2 operation gestalt is the same composition as the 1st operation gestalt, the same sign is given to each portion, explanation of composition is omitted, and only a portion which is different from the 1st operation gestalt with reference to the flow chart of drawing 9 hereafter about the face field extraction and concentration data processing concerning a **** 2 operation gestalt is explained.

[0097] In addition, the face field extraction and concentration data processing concerning a **** 2 operation gestalt are the processings to which the image-processing method concerning invention of a claim 3 was applied, and is realized by performing face field extraction and a concentration amendment program by CPU46 of the auto setup engine 44. Face field extraction and a concentration amendment program at the beginning The information-storage medium 72 (refer to drawing 1) memorizes, and the information read-out equipment (illustration ellipsis) connected to the personal computer 42 is loaded with the information-storage medium 72. If import of the program from the information-storage medium 72 to an image processing system 14 is directed, with information read-out equipment, face field extraction, a concentration amendment program, etc. will be read from the information-storage medium 72, and ROM50 which can rewrite the content of storage will memorize. And if the timing which should perform face field extraction and concentration amendment processing comes, face field extraction and a concentration amendment program will be read from ROM50, and face field extraction and a concentration amendment program will be performed by CPU46. Thereby, the auto setup engine 44 functions as an image processing system concerning invention of a claim 7. Thus, the information-storage medium 72 concerning a **** 2 operation gestalt is equivalent to the record

medium according to claim 9.

[0098] In the face field extraction and concentration data processing concerning a ***** 2 operation form, face candidate field extraction processing is performed (Step 100), and the existence of top-and-bottom information is judged (Step 102), when there is top-and-bottom information, it shifts to Step 200, and the data of a single face candidate field are incorporated out of the face candidate field extracted by face candidate field extraction processing. Step 202 is searched for whether the field of the concentration pattern of a convex exists in the direction of high concentration to the face candidate field which incorporated data in the field and the direction of low concentration (the high brightness direction) of a concentration pattern of a convex at Step 200. In addition, Step 202 corresponds to the 2nd extraction means according to claim 7.

[0099] Among the face fields equivalent to a person's face, as concentration shows the field beyond a predetermined value (high concentration field) as an example to drawing 10 (A), it exists in the field (***** field) equivalent to ***** and its circumference, and the concentration change in a ***** field serves as a change pattern of a convex in the direction of high concentration with the steep inclination, as shown in drawing 10 (B). In addition, since it exists in the position where an eyeball, an eyelid, eyelashes, eyebrows, etc. approached the ***** field and ***** and its circumference have become depressed among a person's faces although the actual concentration change in a ***** field is more complicated, the near concentration change in a ***** field shows a change pattern as shown in drawing 10 (A).

[0100] Moreover, as the brightness [exist in the field equivalent to the field equivalent to the field (gena field) which is equivalent to a gena as brightness shows the field beyond a predetermined value (high brightness field) as an example to drawing 11 (A) among the face fields equivalent to a person's face, or a nose, and a frame, for example,] change in a gena field is shown in drawing 11 (B), it is the change pattern of a convex in the high brightness direction with the loose inclination. Therefore, when the face candidate field of a processing object is a face field equivalent to a person's face, by processing of Step 202, a ***** field will be extracted as a field of the concentration pattern of a convex in the direction of high concentration, and a gena field will be extracted as a field of the concentration pattern of a convex in the direction of low concentration.

[0101] At the following step 204, it judges whether the concentration pattern was discovered by search of Step 202. When a judgment is denied, since possibility that it is not a face field is very high, the face candidate field of a processing object substitutes 0 for Step 206 at the coherency as a face field, and shifts to Step 210. On the other hand, when the judgment of Step 204 is affirmed, shift to Step 208, and it is based on the direction of top and bottom which top-and-bottom information expresses. the position in the face field of the concentration pattern space discovered and extracted at Step 202, and area (the configuration of the gray level histogram about a concentration pattern space --) The coherency as a field which is based on that the methods (for example, the inclination of concentration change, the ratio of the height of thread in a concentration pattern and the size of foot, etc.) of change of the concentration in a concentration pattern space may be included, and is equivalent to ***** and a gena about all the extracted concentration pattern spaces is judged.

[0102] That is, when the face candidate field of a processing object is a face field, possibility of being predetermined numeric-value within the limits for which it exists in the block internal affairs which the concentration pattern space of a convex shows by hatching at drawing 4 (B) respectively, and the surface ratio of the aforementioned concentration pattern space and the face candidate field of a processing object is also equivalent to the surface ratio as a ***** field in the direction of high concentration equivalent to a ***** field is high. Therefore, the coherency as a field which corresponds in the direction of high concentration at the eye section of the concentration pattern space of a convex For example, set up the range (block pair shown in drawing 4 (B) by hatching) in which the ***** field should exist on the basis of the direction of top and bottom which top-and-bottom information expresses, and while asking for the degree of coincidence of the set-up range and the position of the aforementioned concentration pattern space It can ask for the degree of coincidence as compared with the predetermined numerical

range which is equivalent to the surface ratio as a **** field in the surface ratio of the aforementioned concentration pattern space and the face candidate field of a processing object, and can judge using a two-dimensional map etc. based on both degrees of coincidence.

[0103] Moreover, when the face candidate field of a processing object is a face field, possibility of being predetermined numeric-value within the limits for which it exists in the block internal affairs which the concentration pattern space of a convex adjoins under the block shown in drawing 4 (B) by hatching respectively, and the surface ratio of the aforementioned concentration pattern space and the face candidate field of a processing object also corresponds in the direction of low concentration equivalent to a gena field (the high brightness direction) at the surface ratio as a gena field is high. therefore, also about the coherency as a field which is equivalent to the gena of the concentration pattern space of a convex in the direction of low concentration For example, the range (block pair which adjoins under the block shown in drawing 4 (B) by hatching) in which the gena field should exist on the basis of the direction of top and bottom which top-and-bottom information expresses is set up. While asking for the degree of coincidence of the set-up range and the position of the aforementioned concentration pattern space It can ask for the degree of coincidence as compared with the predetermined numerical range which is equivalent to the surface ratio as a gena field in the surface ratio of the aforementioned concentration pattern space and the face candidate field of a processing object, and can judge using a two-dimensional map etc. based on both degrees of coincidence.

[0104] And at Step 209, it is based on the coherency judged to each extracted concentration pattern space, the coherency as a face field is calculated and set up to the face candidate field of a processing object, and it shifts to Step 210. In addition, as a coherency of a face field, the totalizer of the coherency for every concentration pattern space etc. can be used, for example.

[0105] In addition, although the coherency as a field which is equivalent to **** or a gena to the concentration pattern space extracted above is judged, you may make it also judge collectively the coherency as a field which is especially equivalent to a nose or a frame to the concentration pattern space of a convex in the direction of low concentration. However, since **** and the gena accept and exist in the abbreviation right-and-left symmetric position of a face field to recognizing couple existence in the one center of abbreviation in which the nose and the frame met the longitudinal direction of a face field It is, not the field in which this concentration pattern space is equivalent to a nose or a frame in fact though the coherency as a field which is equivalent to a nose or a frame about a specific concentration pattern space becomes high but when a coherency becomes high by chance, and as compared with the eye section or a gena, the reliability of a coherency judging is low a little. For this reason, as for the coherency as a field which is equivalent to a nose or a frame in a setup of the coherency as a face field to a face candidate field, it is desirable to set up so that it may be reflected in the coherency as a face field by low weight.

[0106] At the following step 210, it judges whether all face candidate fields were processed (judgment of a coherency). When a judgment is denied, it returns to Step 200, and processing and a judgment of Steps 200-208 are respectively performed to each face candidate field. By this, the coherency as a face field will be respectively judged and set up to each face candidate field. If the judgment of Step 210 is affirmed, it will shift to Step 244.

[0107] On the other hand, when the judgment of Step 102 is denied, it shifts to Step 220 (when there is no top-and-bottom information). After incorporating the data of a single face candidate field out of the face candidate field extracted by face candidate field extraction processing of Step 100, it sets to the following step 222. It searches for whether the field of the concentration pattern of a convex exists in the direction of high concentration in the field and the direction of low concentration (the high brightness direction) of a concentration pattern of a convex like previous Step 202. This step 222 also corresponds to the 2nd extraction means according to claim 7.

[0108] At Step 224, it judges whether the concentration pattern was discovered by search of Step 222. When a judgment is denied, since possibility that it is not a face field is very high, the face candidate field of a processing object substitutes 0 for Step 226 at the coherency as a face field, and shifts to Step 238.

[0109] On the other hand, when the judgment of Step 224 is affirmed, it shifts to Step 228 and 1 is substituted for Variable n. at the following step 230 It is based on the position and area in the face field of the concentration pattern space discovered and extracted at Step 222 by making the n-th direction (it being the 1st direction in this case) into criteria (the direction of top and bottom). The coherency as a field which is equivalent to the coherency and gena as a field equivalent to the eye section about all the extracted concentration pattern spaces is judged. And at the following step 231, the coherency as a face field is calculated and set up to the face candidate field of a processing object based on the coherency judged to each extracted concentration pattern space like previous Step 209.

[0110] At Step 232, when it judges whether the value of Variable n was set to 4 and a judgment is denied, only 1 increments the value of Variable n at Step 234, and it returns to Step 230. By this, at Steps 230 and 231, the 1st – the 4th direction will be respectively assumed to be the directions of top and bottom, and the coherency as a face field will be respectively judged to the face candidate field of a processing object.

[0111] If a coherency is respectively judged about each direction, the judgment of Step 232 will be affirmed, it will shift to Step 236, and the direction where the coherency became the maximum among the 1st – the 4th direction will be memorized. At the following step 238, it judges whether it processed to all face candidate fields. When a judgment is denied, it returns to Step 220, and Steps 220–238 are repeated. Thereby, the coherency as a face field is respectively judged about the 1st – the 4th direction to all face candidate fields.

[0112] If the judgment of Step 238 is affirmed, it will shift to Step 240, and the coherency respectively memorized about each face candidate field at previous Step 236 judges the direction of top and bottom of a picture like Step 138 explained with the 1st operation form based on the greatest direction. At the following step 242, the coherency as a face field for every face candidate field about the predetermined direction corresponding to the judged direction of top and bottom is set as each face candidate field, and it shifts to Step 244.

[0113] And at Step 244, weight mark are set up to each face candidate field according to the coherency set up to each face candidate field. This step 244 corresponds to the evaluation means according to claim 7 with Steps 208, 209, 230, 231, and 242. It can carry out by changing a coherency into the weight mark P also about a setup of the weight mark in Step 244 using this map using the map on which the transfer characteristic was set that a coherency follows on becoming high and the weight mark P become high as shown in drawing 6 (A) and drawing 6 (B) as an example. In addition, since the processing after the following step 144 is the same as that of the 1st operation form, explanation is omitted.

[0114] The concentration pattern space which the concentration pattern peculiar to **** and a gena has produced in the above is extracted. It is based on the position and surface ratio in a face candidate field of the extracted concentration pattern space. Judge the coherency as a field equivalent to the coherency and gena as a field equivalent to the eye section of the extracted concentration pattern space, and the coherency as a face field to a face candidate field is judged. Since the weight mark to a face candidate field are set up based on the aforementioned coherency, based on the internal structure of a person's face, the accuracy as a face field can be evaluated with a sufficient precision to a face candidate field. Moreover, since there is no need of performing repeat processing, like the field division based on binarization, changing a threshold while being able to prevent that the precision of the evaluation to a candidate field falls, even if it is the case where the edge does not exist in the rim of the field which is above equivalent to the eye section or a gena, processing is also simplified.

[0115] In addition, although it was correcting to the face candidate field with which the maldistribution degree of that it is beyond the 1st predetermined value and a background candidate field is [the surface ratio of a background candidate field / whether it is beyond the 2nd predetermined value] above satisfied of one [at least] judgment of ** so that weight mark might fall In performing not the thing limited to this but processing which extracts a face field from a face candidate field extraction of this face field -- setting -- the above -- you may change a threshold so that the threshold for a face field judging may become high to the face candidate field with which it is satisfied of one judgment even if few, as shown in drawing 8 (B) as

an example Thereby, the face candidate field where possibility of being a background region is comparatively high can carry out that it is hard to be extracted as a face field. In addition, threshold THF It is good also as constant value, the difference of the surface ratio of a background candidate field and the 1st predetermined value and the difference of the maldistribution degree of a background candidate field and the 2nd predetermined value are embraced, and the amount of change is Threshold THF. You may change the amount of change. [0116] Moreover, you may make it change the weight mark P set as each face candidate field, the threshold THF for a face field judging, or the weight given to the concentration M of each face candidate field in the face field concentration Mface according to the kind of image processing performed using the processing result of face field extraction and concentration data processing.

[0117] For example, it sets to an image processor 40 using the extraction result of the face field by face field extraction and concentration data processing. Although it is dependent also on the grade of sharpness emphasis, or the kind of filter when sharpness emphasis processing in which the sharpness of a face field is emphasized covering an edge emphasis filter locally only to the extracted face field is performed Though emphasis of sharpness is performed also to the field which is not a face field in fact, a visual-sense top has a thing with a small (it is not conspicuous) bad influence. in such a case, threshold THF for a face field judging A value is made smaller than usual (namely, the criteria of selection of a face candidate field -- changing), and more face candidate fields may be made to judge to be a face field. Threshold THF for a face field judging Since the probability by which a misjudgment law is carried out will become low if the face candidate field corresponding to an actual face field is not a face field as a value is made low, by the above, it cannot leak to the face field in a picture, and sharpness emphasis processing can be performed.

[0118] Moreover, threshold THF for a face field judging More face candidate fields are able to replace with changing a value and to judge to the coherency indicated in the degree of coincidence indicated in the 1st operation form, or the 2nd operation form by what (that is, for the criteria of the evaluation to each face candidate field to be changed) the bigger value as weight mark P than usual is set up for to be a face field. Especially, as sharpness emphasis processing, when processing which strengthens the emphasis degree of sharpness is performed as the weight mark P become large, it also becomes possible to control the emphasis degree of sharpness strength by setting up the weight mark P as mentioned above.

[0119] Moreover, although it is dependent also on the grade of concentration amendment when amendment concentration amendment processing is locally performed in concentration for example, based on the face field concentration Mface only to the extracted face field using the extraction result of a face field and the face field concentration Mface by face field extraction and concentration data processing Though concentration amendment is performed also to the field which is not a face field in fact, a visual-sense top has a thing with a small (it is not conspicuous) bad influence. In such a case, threshold THF for a face field judging A value is made smaller than usual and more face candidate fields may be made to judge to be a face field. Threshold THF for a face field judging Since the probability by which a misjudgment law is carried out will become low if the face candidate field corresponding to an actual face field is not a face field as a value is made low, by the above, it cannot leak to the face field in a picture, and concentration amendment processing can be performed.

[0120] Although the above-mentioned explanation is the case where an image processing with small influence is performed, in extraction of a face field when the field which is not a face field is accidentally extracted as a face field in fact conversely, when the image processing influenced [great when the field which is not a face field in fact is accidentally extracted as a face field] is performed For example, threshold THF for a face field judging Only the face candidate field where the accuracy as a face field is higher is able to be extracted as a face field by setting [as opposed to / the degree of coincidence, or a coherency / in making a value larger than usual ****] up the value smaller than usual as weight mark P.

[0121] Moreover, the face field concentration Mface which can be found by previous (1) formula ((2) formulas are sufficient) also about face field concentration as shown, for example in the

following (3) formulas Weighted-average-efficiency Mface' with other picture characteristic quantity D (for example, average concentration of the whole picture, average concentration of a non-face candidate field, etc.) When calculating however, (a weighting factor [as opposed to the face field concentration Mface in αF] and a weighting factor [as opposed to the picture characteristic quantity D in $\alpha 0$]) as face field concentration, The kind of image processing performed using the calculated face field concentration is embraced, and it is weighting-factor αF and $\alpha 0$. You may make it change the weight given to the concentration M of each face candidate field by what (that is, for the criteria of weighting to each face candidate field to be changed relatively) a value is changed for.

[0122]

$Mface' = \alpha F \cdot Mface + \alpha 0 \cdot D$ -- (3)

moreover, as an image processing performed using the processing result of face field extraction and concentration data processing Two or more sorts of image processings from which the demand to the processing result of face field extraction and concentration data processing differs (for example, that the field which is not a face field in fact is not intermingled in the extracted face field with a desirable image processing) When an image processing with desirable including all the face fields in a picture in the extracted face field etc. is performed respectively, corresponding to each image processing, you may perform extraction of a face field, and the operation of face field concentration two or more times. As the degree of coincidence and a coherency can be used as reliability (accuracy) as a face field of each face candidate field and were mentioned above with this operation form By changing at least one of the criteria of weighting to the criteria of a weight mark setup over each face candidate field, the criteria (threshold THF) of a face field judging, and each face candidate field Since the result which each image processing requires as a face field extraction result or the face field concentration result of an operation can be obtained respectively When two or more aforementioned sorts of image processings are performed respectively, very complicated and time this face candidate field extraction processing It is not necessary to repeat several said times with the number of kinds of an image processing, changing processing conditions corresponding to two or more aforementioned sorts of image processings, the processing time of face field extraction and concentration data processing can be shortened, and improvement in a performance of an image processing system 14 can be realized.

[0123] Moreover, although the above explained the case where calculated the processing conditions which include face field extraction and concentration data processing with the auto setup engine 44 based on press can image data, and the actual image processing to fine scan image data was performed by the image processor 40 It may be made to perform the image processing in the operation of processing conditions, and the calculated processing conditions in order not to the thing limited to this but to single image data, and may be made to perform these processings of a series of in the single processing section.

[0124] Furthermore, although extraction of a face field and the operation of face field concentration were respectively performed based on the weight mark set up to each face candidate field in the above, it is not limited to this and may be made to perform only either.

[0125] Moreover, although the image data obtained by reading the picture recorded on the photographic film above was made into the processing object, it is good also considering the image data obtained by reading the picture which is not limited to this and recorded on other record material, such as paper, the image data obtained by the image pick-up by the digital camera, or the image data generated by computer as a processing object. Moreover, this invention cannot be overemphasized by that the film picture recorded on the photographic film may be used for the determination of the exposure conditions at the time of carrying out exposure record by field exposure at printing paper.

[0126] Moreover, although the case where the field which is above equivalent to the face of the person in a picture was made into the principal part was explained, invention of a claim 5 is not limited to this. It is also possible to apply invention of a claim 5 in extracting the field corresponding to the aforementioned parts, a product, etc. from the picture which extracted the picture which expresses the situation by which conveyance is carried out [aforementioned]

while picturizing the situation that the parts produced in mass production method of parts, a product, etc., the product, etc. are conveyed in order from the image pick-up signal to predetermined timing, and was extracted as an example as a field equivalent to the principal part etc. In this case, the extracted principal part field can be used for inspecting automatically parts, a product, etc. which were produced, for example etc.

[0127]

[Effect of the Invention] As explained above, a claim 1 and invention according to claim 6 While dividing equivalent to the face of the person in a picture, then the candidate field presumed into the small field of a predetermined number Calculate the characteristic quantity relevant to the concentration in a small field or the frequency of change of brightness, and the size of change for every smallness field, and it collates with the pattern showing the relation of the aforementioned characteristic quantity for every smallness field when dividing the field equivalent to a person's face into the small field of a predetermined number. Since the accuracy as a field equivalent to the face of the person of a candidate field is evaluated, it has the outstanding effect that simple processing can extract the field equivalent to a person's face with a sufficient precision based on the internal structure of a person's face.

[0128] Since invention according to claim 2 divides a partition-pair elephant field so that it may be located in the small field where the fields equivalent to each eye section which constitutes ***** of a person's face differ, it has the effect that the accuracy as a field equivalent to a person's face to a candidate field can evaluate with a more sufficient precision in addition to the above-mentioned effect, in invention of a claim 1.

[0129] It is based on the distribution of the concentration in that a claim 3 and invention according to claim 7 are equivalent to a person's face, then the candidate field presumed, or brightness. The field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced is extracted. It is based on at least one of the configurations of the histogram of the position in the candidate field of the extracted field, surface ratio with a candidate field, concentration, or brightness. Since the accuracy as a field which judges the adjustment as a field equivalent to the specific portion of the extracted field, and is equivalent to the face of the person of a candidate field is evaluated It has the outstanding effect that simple processing can extract the field equivalent to a person's face with a sufficient precision based on the internal structure of a person's face.

[0130] Invention according to claim 4 extracts the field which the pattern of the concentration of a convex or brightness has produced in the direction of high concentration, or the low brightness direction in invention of a claim 3. The field which judged the adjustment as a field corresponding to the eye section of the extracted field, or the pattern of the concentration of a convex or brightness has produced in the direction of low concentration or the high brightness direction is extracted. Since the adjustment as a field corresponding to the gena of the extracted field is judged, it has the effect that accuracy as a field equivalent to a person's face to a candidate field can be evaluated with a more sufficient precision in addition to the above-mentioned effect.

[0131] That invention according to claim 5 is equivalent to the principal part in a picture, then when the lightness of the candidate field presumed is beyond a predetermined value The background candidate field where the difference of lightness with a candidate field consists of the pixel of predetermined within the limits When the surface ratio to the candidate field of the background candidate field which searched within the limits of outside a candidate field, and was extracted is beyond a predetermined value, Or since evaluation of the accuracy as a field equivalent to the principal part to a candidate field is made low when the extracted background candidate field is unevenly distributed in the periphery section in a picture It has the outstanding effect that the field equivalent to the background in a picture can suppress being incorrect-extracted as a field equivalent to the principal part.

[0132] While dividing that invention according to claim 8 is equivalent to the face of the person in a picture then the 1st step which extracts the candidate field presumed, and the extracted candidate field into the small field of a predetermined number The 2nd step which calculates the characteristic quantity relevant to the concentration in a small field or the frequency of change

of brightness, and the size of change for every smallness field, It collates with the pattern showing the relation of the characteristic quantity for every smallness field when dividing into the small field of a predetermined number the field which is equivalent to a person's face in the characteristic quantity calculated for every smallness field. Since the program for making a computer perform processing containing the 3rd step which evaluates the accuracy as a field equivalent to the face of the person of a candidate field was recorded on the record medium It has the outstanding effect that simple processing can extract the field equivalent to a person's face with a sufficient precision based on the internal structure of a person's face.

[0133] That invention according to claim 9 is equivalent to the face of the person in a picture, then the 1st step which extracts the candidate field presumed, The 2nd step which extracts the field which the pattern of concentration peculiar to the specific portion of a person's face or brightness has produced based on the distribution of the concentration in the extracted candidate field, or brightness, It is based on at least one of the configurations of the histogram of the position in a candidate field of the extracted field, surface ratio with a candidate field, concentration, or brightness. The adjustment as a field equivalent to the specific portion of the extracted field is judged. Since the program for making a computer perform processing containing the 3rd step which evaluates the accuracy as a field equivalent to the face of the person of a candidate field was recorded on the record medium It has the outstanding effect that simple processing can extract the field equivalent to a person's face with a sufficient precision based on the internal structure of a person's face.

[Translation done.]

* NOTICES *

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- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram of the image processing system concerning this operation gestalt.

[Drawing 2] It is the flow chart which shows the content of the face field extraction and concentration data processing concerning the 1st operation gestalt.

[Drawing 3] It is the flow chart which shows the content of background region judging processing.

[Drawing 4] It is the conceptual diagram showing respectively an example of the pattern for matching for collating with the block of a predetermined number with which (A) was obtained by division of a face candidate field and (B) was obtained by division.

[Drawing 5] It is the conceptual diagram showing an example of the differentiation filter for calculating a concentration change value (edge intensity).

[Drawing 6] (A) And (B) is the diagram showing respectively the map for setting weight mark as a face candidate field according to the degree of coincidence with the pattern for matching.

[Drawing 7] It is the image view showing an example of a picture with high possibility that a background region will be incorrect-extracted as a face candidate field.

[Drawing 8] The diagram showing the map for correcting the weight mark to the face candidate field where possibility that (A) is a background region is comparatively high, and (B) are the diagrams explaining change of the threshold for a face field judging when the aforementioned face candidate field exists.

[Drawing 9] It is the flow chart which shows the content of the face field extraction and concentration data processing concerning the 2nd operation gestalt.

[Drawing 10] The image view in which the concentration in a face field shows an example of a distribution of the high concentration field beyond a predetermined value, and (B) of (A) are the diagrams showing an example of the concentration change in the field which is equivalent to the eye section among face fields.

[Drawing 11] The image view in which the brightness in a face field shows an example of a distribution of the high brightness field beyond a predetermined value, and (B) of (A) are the diagrams showing an example of the brightness change in the field which is equivalent to a gena among face fields.

[Description of Notations]

10 Image Processing System

14 Image Processing System

40 Image Processor

44 Auto Setup Engine

72 Information-Storage Medium

[Translation done.]

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実証研究 来訪求 訪求項のは9 OL (全23国)

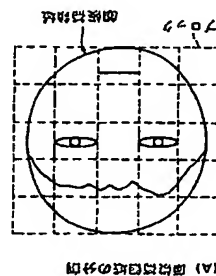
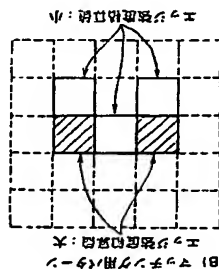
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(54) 【発明の名称】 画像処理方法、画像処理装置及び記録媒体

【57】【要約】

【評述】人物の顔の内部構造に基づき、人物の顔に相当する頭流を簡易な処理で精密度よく抽出する。

【解決手段】 処理対象の顔面から人物の眼に相当する領域と特定される領域情報は抽出し、顔検出処理を所定数のブロックに分列し、分列したブロックを(A)に仮設で示すブロック毎に逐次入力されたエッジ情報の精査処理を各ブロック毎に実行する。各ブロック毎に求めた特徴値を、実際に人物の顔に相当する顔検出値を前記分割パターンに使用して分割し各ブロック毎にエッジ強度精査処理を実行して求めたマッチング用パターン(B)(参照)と照合し、顔検出処理に対し人物の眼に相当する領域(顔検出)としての精度を評価する。



【附設の卒業生特待】

【請求項1】 画像データに基づいて、該画像データが表す画像中の人物の顔に相当すると推定される候補領域を抽出し、

とに記し出出した焼酎類は所定数の小瓶箱に分割すると共に、小瓶箱内における温度又は湿度変化の程度及び変化する大きさに関する特徴値を各小瓶箱に求め、前記特徴値を各小瓶箱毎に決めた特徴値と、人物の顔に相当する前記特徴値の関係を表すパターンテンプレートを作成することにより、前記特徴値の顔面に相当する前値としての顔面特徴値と前記顔面特徴値との類似度を算出する。

【請求項2】 人物の顔の眼部対を構成する個々の眼部に相当する領域が異なる小領域内に位置するように、分割対毎領域毎を前記所定数値の小領域に分割することを特徴とする請求項1記載の国戦図解方法。

(請求項3) 画像データに基づいて、該画像データが表す画像中の人物の顔に相当すると推定される候補顔を抽出し、

前記抽出した候補領域内の速度又は加速度の分布に基づいて、人物の顔の特定の部分に特有の速度又は加速度のパターンが生じている領域を抽出し、

前記抽出した領域の、候補領域内における位置、候補領域と抽出した領域との面積比、速度又は傾度のヒストグラムの形状の少なくとも1つに基づいて、前記抽出した領域の編記特定の部分に相当する領域としての整合度を判定し、前記候補領域の人物の顔に相当する領域としての整合度を評価する。同様の処理方法。

【請求項4】 人物の顔の眼部に特有の高温度方向又は低温度方向に凸の温度又は凹度のパターンが生じている領域を抽出し、抽出した領域の前記眼部に対応する領域としての適合性を判定するか。

又は人物の顔の傾角に特有の低温度方向又は高温度方向に凸の温度又は傾度のパターンが生じている領域を抽出し、抽出した領域の傾度傾角に対応する傾度としての整合性を判定することを特徴とする請求項3記載の画像処理方法。

【請求項5】 画像データに基づいて、該画像データが表す画像中の主要部に相当すると判定される区域領域を抽出し、

前記抽出した候補領域の明度が所定値以上の場合に、前記候補領域との明度の差が所定範囲内の画素から成る付着領域を抽出し、前記候補領域外の範囲内で探索し、着脱領域を抽出する。

商品背照像領域が抽出され、かつ抽出された背景領域が
領域の前記底領域に対して面積比が所定値以上の場
合、又は抽出された背景領域領域が画像中の周縁部に属
在している場合に、前記底領域に対してする王冠部に相当
する知識としての知識の信頼を低くする画像処理方法。

【請求項6】 画像データに基づいて、該画像データが表す画像中の人物の顔に相当すると推定される領域を抽出

を抽出する第1の抽出手段と、

を、小畑城町に米の貯蔵手段と、

前記諸實手段によつて前記各小領域毎に求められた特徴量を、人物の顔に相当する領域を前記所定数の小領域に分割したときの各小領域毎の前記特徴量の関係を表すバターンと照合することにより、前記各小領域毎の人物の新に相当する領域としての領域を評価する評価手段と、

【請求項7】 画像データに基づいて、該画像データが表す画像中の人物の顔に相当すると推定される顔領域を抽出する第1の抽出手段と、

前記抽出した知能の、精神知能内における位置、技術知能との相関係数、知能又は程度のヒストグラムの形状の少くなくとも一つに基づいて、前記抽出した知能の前記程度と部分に相当する知能としての整合性を判定し、前記知能知能の人物の標に相当する知能としての確度を評価する算知手段と、

を含む映像配信装置。

解は抽出した候補領域を所定数の小領域に分割すると共に、小領域内における温度又は湿度の変化の傾度及び変化の大きさに関連する特徴量を各小領域毎に求める第2のステップ、

前記各小領域毎に求めた位置量を、人物の顔に相当する領域を前記所定数の小領域に分割したときの各小領域毎の前記位置量の関係を表したマトリクスを照合することにより、前記領域毎の人物の顔に相当する位置をコンピュータは各小領域毎の3つのステータップを含む処理をコンピュータに実行させるためのプログラムが記された記録媒体は、
【請求項9】 前記データに基づいて、該人物データが表す画像中の人物の顔に相当すると推定される各領域の位置を求め、その位置にステータップ

前記抽出した候補領域内の領域又は程度及び程度の方角に基づいて、人物の顔の特定の部分に特化した速度又は程度のパターンが生じている領域を抽出する第2のステップ。

前記抽出した領域、又は候補領域内における位置、候補領域との面積比、速度又は程度とのスコア上の形状の少なくとも一つに基づいて、前記抽出した領域の端記号特定の部分に相当する領域としての等価性を判定し、前記候補領域の人物の顔に相当する領域としての速度を特定する第3のステップをコンピュータによって実行させる。

るためのプログラムが記述された記述媒体。

【発明の詳細な説明】

[0001]

【発明の出す技術分野】本発明は前記処理方法、画像処理装置及び記録媒体に係り、特に、画像中の人物の顔面を抽出する処理方法、及び前記抽出処理方法を適用可能な画像処理装置、及び前記抽出処理方法をコンピュータで実行するためのプログラムが記録された記録媒体に関する。

【0002】
〔従来の技術〕人物写真を撮影するときに最も注目されるのは人物の顔である。例えば写真フィルム等に記録された原画像を印刷紙等の記録材料に露光記録（面露光）し、或いは走査露光により記録する場合には、人物の顔の色及び濃度が適正となるように露光を制御することが望ましいが、この露光制御を実施するためには原画像中の人物の顔に相当する領域の色や濃度を正しく検知する必要がある。また、画像を拡大するときに得られた画像データに対し、該画像データを表示する画像の画質向上を目的として開示された種々の画像処理の中には、画像中の人物の顔に相当する領域又はその一部に対してのみ特定の画像処理（例えば局所的な濃度補正や水目修正等）を実施するものがあるが、この処理を行うためには画像中の人物の顔に相当する領域の位置や大きさを正確に検知する必要がある。

【0003】このため、従来より、面像中の人物の顔部分の某部分に相当すると推定される領域を抽出するための手法が種々提案されている。例えば特開平8-184925号公報には、面像データに基づいて、面像中に存在する人物の名前に特有な形状パターン（例えばは頭部の輪郭、顔の輪郭、顔の内部構造、顔体の顔部等を表す形状パターン）の向かい1つを探索し、抽出した形状パターンの大きさ、向き、抽出した形状パターンが表す人物の所定部分と人物の顔との位置関係に依じて、人物の顔に相当する領域としての整合性が高い領域（候補領域）を特定すると共に、抽出した形状パターンと異なる他の形状パターンを探索し、先に特定した候補領域の、人物の顔としての整合性を評価し、人物の顔に相当すると推定される領域（顔領域）を抽出する領域抽出の方法が開示されている。

(0004)

【光明寺解決しようとする意図】上記六幅面に記載の技術では、二酸化により処理対象の画像を付加域と非付加域とはに分別しており、例えば顔の内側部分に基づいて輪郭領域は分割して得られていた。しかしながら、人物の顔の頭部には対応する領域として人物の頭の頭部に相当すると判定される黒色の領域は抽出されず、抽出された黒色域に基づいて領域領域を設定している。しかしながら、処理対象の画像の顔領域は一定ではなく、頭部の所謂黒目の部分の位置が

も一定ではないので、脚部に相当する領域を精放長ぐ拙
出するためには、二傾化に用いる閾値を変更しながら、
二傾化による領域分割を含む上記の処理を複数回繰り返
し、各回の処理で抽出された領域を評価する必要がある
。従って、処理に多大な時間がかかるという問題があ
った。

【0005】また二酸化では、例えば人物の顔の眼瞼に相当する領域と、両眼の間の必然的領域と眼瞼に相当する領域とが画面上で隣接している場合に、眼瞼に相当する領域と顔領域の高速度域に相当する黒領域と結合することがあり、この場合、眼瞼に相当する領域を正しく抽出することが困難になるという問題がある。この問題は、二酸化に代わる方法として上記公報中に記載されている、画像から抽出したエッジ（濃度又は輝度）が所定値以上変化している部分）に基づいて画像を分割する場合においても、眼瞼に相当する領域と他の黒領域に相当する領域との境界における濃度又は輝度の変化が小さければ同様に至り得る。

【0006】このように、湖の内部構造を利用した従来の処理では、抽出対象である湖内部の特定部分に相当する領域を正しく抽出できなかった場合に、人物の顔に相当する領域を精度良く抽出することができない、という問題があった。

【0007】ところで、人物等の主要部を含むシーンを低感度した場合、画像中の主要部に相当する領域は、ストロボを発光させて撮影したときも含めて、背景に相当する領域よりも高感度となる場合がある。このため、主観的に相当する領域としても低感度の領域は除外されて高感度の領域が抽出されることが多いが、これに伴い、処理対象の領域が逆光の照明条件下で、人物中の主要部を含むシーンを透過する画像であった場合に、画像中の高感度の背面部部を主主要部に相当する領域として抽出することがあった。この場合、抽出した領域の色及び温度に基づいて記録された材料に画像を露光記録する際の感光量を制御したいとすることがある。そこで、抽出した領域の色及び温度に基づくものと、記録画像は、主要部に相当する領域が黒く塗りつぶされた状態の画像になる。

【0008】本発明は上記事実を考慮して成されたもので、人物の顔の内部構造に基づき、人物の顔に相当する領域を容易な処理により精度良く抽出することができる面像処理方法、面像処理装置及び記憶媒体を得ることが第1の目的である。

【0009】また本発明は、画像中の背景に相当する領域が主要部に相当する領域として抽出されることを抑制できる画像処理方法を得ることが第2の目的である。

{0010}

【課題を解決するための手段】第1の目的を達成するために、請求項1記載の発明に係る画像処理方法は、画像データに基づいて、該画像データが表す画像中の人物の顔に相当すると推定される候補領域を抽出し、前記抽出した候補領域を所定数の小領域に分割すると共に、小領域

域内における速度又は程度の変化の傾度及び変化の大きさに関連する特徴数を各小領域毎に求め、前記各小領域毎に求めた特徴数を、人物の顔に相当する領域を特定し、定数の小領域に分類したときの各小領域毎の前記特徴数の間隔を数すパターンと照合することにより、前記候補人物の人物の顔に相当する領域としての傾度を評価する。

【0011】画像生成の発明では、まず、画像データに基づいて、該画像データが表す画像中の人物の顔に相当すると推定される顔検出域を抽出する。この顔検出域の抽出に際しては、従来より周知の任意のアルゴリズムを適用可能である。次に、抽出した顔検出域を所定数の小領域に分割すると共に、小領域内における顔度又は顔度の变化の傾度及び変化の大きさに関連する特徴量を各小領域毎に求める。なお、顔度又は顔度の变化の傾度及び変化の大きさに関連する特徴量としては、例えば所定方向に沿って隣り合う面式間の顔度又は顔度の变化量を算出していくことを、各小領域毎に行うことで非のることができ、

【0012】画面中の人物の顔に相当する領域には、温度又は顔色が変化する成分と、温度又は顔色の変化が緩やかである領域又は顔色が殆ど一定の領域に各々存在している。例えば、おおかみやその他の動物に各々存在している。例えばは顔記号域のうち顔部がその周辺に相当する成分は内では、眼珠、瞳、睫毛等が近接した位置に存在しており、眼珠内の瞳孔や虹彩の周辺でも温度や顔色が濃縮に変化している（特に、眼珠、瞳、睫毛、眉毛等）大まきく変化した（特に、眼珠、瞳、睫毛、眉毛等の配列方向、すなわち顔の上下の向きについて）。一方、は顔色の変化の領域や変化の大きさや火きい）。一方、人物の顔に相当する領域のうち鼻部とその周辺に相当する部分領域内では、照明条件にもよるが温度や顔色の変化は緩やかである。従って、顔部領域は人物の顔に相当する領域であれば、顔部領域を所定数の小領域に分割して各小領域に求めた特徴量は、各小領域が人物の顔の何れの部分に対応しているかによって大抵に異なるものなる。

【0013】請求項1の発明では、各小領域毎に求めた特徴量と、人物の顔に相当する領域を所定数の小領域に分割したときの各小領域毎の顔特徴量との関係を示すパターン照合することにより、候補領域の人物の顔に相当する領域としての精度を評価する（例えば各小領域は顔領域が高出台に前記評価を高くする）ので、候補領域に対し、人物の顔の内部領域に基づき、人物の顔に相当する領域としての精度を精度良く評価することができ、そして、候補領域に対する評価精度に基づいて、人物の顔に相当する領域を精度良く抽出することができ

【0014】請求項1の発明では、前内部の指定部分を

特定の部分に特有の速度又は加速度のパターンが生じている部分を抽出し、前記抽出した領域の候補領域内における位置、候補領域との面積比、速度又は加速度のヒストグラムの特徴の少なくとも一つに基づいて、前記抽出した領域の前記特定の部分に相当する領域としての整合性を判定し、前記特定領域の人物の顔に相当する領域としての領域を評価する。

【0020】請求項3記載の発明では、請求項1の発明と同様に、画像データに基づいて、該画像データが表す画像中の人物の顔に相当すると推定される候補領域を抽出し、その後、抽出した候補領域内の速度又は輝度の分布に基づいて、人物の顔の特定の部分に特異な温度又は輝度のパターンが生じる領域を抽出する。

【0021】人物の顔には凹凸があるので、一般性を照
明条件で人物の顔を照明しているシーンを表す画像にお
いては、人物の顔の凹部（例えば眼瞼部）に相当する部分
部では、凹部の底部付近を頂点として低速度方向（低
速度方向）に凸の速度分布を有して分布となる。なお先
に説明したように、凹部とその周辺に相当する部分領域
内では速度又は加速度が非常に大きく変化するとい
うが、凹部に相当する部分領域全体としては上記のよう
な凹凸分布（速度分布）となる。一方、人物の顔の凸部
（例えば頬部）に相当する部分領域では、凸部の頂点
付近を頂点として低速度方向（低速度方向）に凸の速度
分布又は加速度分布となる。

【0022】請求項3の発明では、例えば上記のような人物の顔の特定の部分に特有の迫度又は傾度のパターン内における傾度を抽出し、抽出した傾度の、傾度傾度係数における位置、傾度傾度係数の面積比、強度又は傾度のヒストグラム形状の少なくとも一つに基づいて、抽出した傾度の特定の部分に相当する傾度としての値を判定し、傾度傾度の人物の顔に相当する傾度としての強度を評価するので、傾度傾度に対し、人物の顔の内部構造に基づき、人物の顔に相当する傾度としての強度を精確且つ評価することができ、そして、傾度傾度に対する良好な結果に基づいて、人物の顔に相当する傾度を精度良く抽出することができ、

【0023】請求項3の発明は、エッジに基づき領域分割のうちのエッジが存在している位置で領域を分割するのではなく、エッジが人物の顔の特定の部分に相当する領域の外縁にエッジが存在していない場合であっても、領域分割の外縁にエッジが存在していない場合であっても、領域に対する評価の値が低下することを防止できる。また、二値化に基づき領域分割のように、閾値を定めたから繰り返し処理を行う必要が無いので処理が簡略化され、従って、請求項3の発明によれば、請求項1の発明と同様、人物の顔の内部構造に基づき、人物の顔に相当する領域を面有な処理により精度良く抽出することができ、

【0024】なお、請求項3の発明において、人物の顔

特定の部分に特有の温度又は硬度のパターンとして
は、人物の顔の任意の部分における温度又は硬度のパター
ンを採用することによって、請求項4に記載したと
うに、人物の顔の眼部に特有の高温度域又は低温度
域に凸の温度又は硬度のパターンが生じている領域を
出し、抽出した領域の前記眼部に対応する領域として
使命性を判定する。又は人物の顔の鼻部に特有の低
温度域又は高温度域に凸の温度又は硬度のパター
ンが生じている領域を抽出し、抽出した領域の前記鼻部
に対応する領域として使命性を判定することによ

[illegible][illegible]

【0206】上述した即部や娘部は、人物の顔の部分から見て略左又は略右に位置しているため、即部に当たって略左又は略右のバターンが生じている。従って、娘部には娘部のバターンが生じておらず、抽出した領域が略左右対称な位置に一対抽出されれば、抽出した領域の即部又は娘部に対して一対抽出としての優劣は付与できないと判断することができる。従って、候補領域に対する人物の顔に相当する領域としての似度の評価をより精度良く行うことができる。

(0027)ところで、処理対象の画像が、池元の照明条件で人物等の主要部が存在しているシーンを背景として写像された場合、領域中の高輝度の背景部分が主成分に相当する領域と認識されることがあるが、本装置は明暗比に基づいてこのように誤検出されるケースについて更に検討を行った。その結果、例えばシーン中の空等に対して(複製の前記と認識出力した)場合には誤検出が生ずる高輝度の背景領域が画面上での割合を減らしていき(複製の前記と識別されていない)、場合には誤検出が生ずる高輝度の背景領域が画面中で単一の領域を成していない、例はシーン中の背景部分が高輝度であり、時にはシーン中の背景部分が高輝度によって高輝度の背景領域が複数に分割されている状態を見出した。

【0028】上記に基づき、前記第2の目的を達成するために、請求項5記載の発明に係る画像処理方法は、画

れた歐羅巴域を所定数の小段に分割すると共に、小段毎における速度又は割合の変化の単位及び変化の六等分に関連する特徴量を各小段毎に算出する演習手段と、前記演習手段によって得られた各小段毎の算出結果の総和を、人物の小段毎の口を、人物の如くに相当する前記所定数の小段毎に分割したときの各小段毎の前記算出結果の関係を表すバターンと照合することにより、前記補綴部の人物の顔に相当する領域としての顔像を生成する非特許手段と、を有して構成されているので、請求項1の説明と同様に、人々の顔の内面構造に基づき、人物の如くに相当する領域を自動的に抽出することができ、

【0033】請求項7記載の発明に係る画像処理装置は、前記データに基づいて、該補正データが表す画像中の人物の顔に相当する位置とされる候補領域を抽出する第1の抽出手段と、前記第1の抽出手段によって抽出された候補領域内の顔度又は顔度の分布に基づいて、人物の顔の特定の部分に特定の顔度又は特定のパターンが存在している領域を抽出する第2の抽出手段と、前記抽出した領域の、候補領域内における位置、候補領域との面積比、顔度又は顔度のヒストグラムの形状の少なくとも1つに基づいて、前記抽出した領域の前記特定の部分に相当する領域としての適合性を判定し、前記候補領域に相当する領域としての適合性を判定し、前記候補領域の特定の部分に相当する領域としての適合性を判定し、請求項3の発明と同様に、人物の顔の形状特徴に基づき、人物の顔に相当する領域を探索する処理により精度良く抽出することができ

【0034】請求項記載の発明に係る記憶装置は、前記データに基づいて、時間変データが表す時間中の人物のステータスと規定される候補領域を抽出する第1の処理と、前記抽出した候補領域を所定数の小領域に分けるとともに、小領域内における速度又は傾度の変化の傾度及び変化の大きさに関連する特徴量を各小領域毎に求める第2の処理と、前記各小領域毎に求めた特徴量を、人物の顔に相当する領域を前記特徴量の小領域に分けたときの各小領域毎の傾度と前記特徴量の小領域に一致するとともに、前記候補領域の人物の顔に一致するとともに、前記候補領域の人物の顔に相当する領域としての領域を評価する第3のステップを含む処理をコンピュータに実行させるためのプログラムを含む記憶装置である。

【0035】請求項1記載の発明に係る記録媒体には、上記の例1のソフトウェア内第3のステップを含む処理、すなわち請求項1の発明に係る処理方式に照る処理をコンピュータ1の実行させるためのプログラムが記憶されている。コンピュータが上記記録媒体に記憶されているプログラムを読み出して実行することにより、請求項1の発明と同様に、人物の顔の内部構造に基づき、人物の顔に相当する樹皮を生成することとなる。すなわち、人物の顔の内部構造に基づき、人物の顔の内部構造を生成することとなる。

【0036】請求項9記載の発明に係る記録媒体は、固

後データに基づいて、該特徴データが表す両端中の人物の顔に相当すると判定された候補特徴を抽出する第1のステップ、前記抽出した候補特徴中の特徴又は特徴の部分に基づいて、人物の顔の特徴の部分に特有の属性又は属性のパターンが生じている判定を抽出する第2のステップ、前記抽出した候補の、候補領域内における位置、候補領域とその面積比、属性又は特徴のヒストグラムの形状の少なくとも1つに基づいて、前記抽出した候補の前記特徴の部分に相当する属性としての密着性を判定し、前記候補領域中の人物の顔に相当する属性としての属性を含む第3のステップを含む処理をコンピュータに実行させるためのプログラムを含む記憶媒体。

【0037】請求項9記載の発明に係る記録媒体には、上記の第1のステップ乃至第3のステップを含む処理、すなわち請求項3の発明に記載の画像処理方法に係る処理をコンピュータに実行させるためのプログラムが記録されているので、コンピュータが前記記録媒体に記録されているプログラムを読み出して実行することにより、請求項9の発明と同様に、人物の顔の内部構造に基づき、人物の顔と相当する前肢を簡易な処理により精微良く抽出することができる。

【0038】
【発明の実施の形態】以下、図面を参照して本発明の実施形態の一例を詳細に説明する。

【0039】（第1実施形態）図1には、本発明が適用された画像処理システム10が示されている。画像処理システム10は、スキヤナ12、画像処理装置14及びプリンタ16が直列に接続されて構成されている。

【0040】スキヤナ12は、写真フィルム(例えばネガ
ガフィルムやリバーサルフィルム)等の感光性材料
(以下単に「写真フィルム」と称する)に記録されているフ
ィルム画像(指等物体を撮影後、現像処理されることで可
視化されたもの)が特徴又はボジ商標)を読み取り、該読み
取りによって得られた画像データを出力するものであ
り、光源2から射出され光敏ドラックス22によつてその
光量むらが生ずる光が、フィルムキャリア24にセッ
トされている感光性ガフィルムやリバーサルフィルム等
の「写真フィルム26」に照射され、写真フィルム26を通過
した光がレンズ28を介してCCDセンサ30(エリアア
センサであつてもよい)に感光されてもよい。受光ア
面上に結像されるように構成されている。

【0041】フィルムキヤリア24は、写真フィルム2から6上のフィルム面が露光されている箇所が、光路20からの射出光の光軸にほぼ位置するように写すフィルム2を撮る。これにより、写真フィルム2によって得られていたフィルム画像がCCDセンサ30によって取り込まれ、CCDセンサ30からはフィルム面画素順に対応する信号が出力される。CCDセンサ30から出力された信号はA/D変換器32によってデジタル映像データに変換され、映像処理装置14に入力される。

【0042】画像処理装置14のラインセンサナ補正部36は、入力されるセンサデータ（スキナ12から入力されるR、G、Bのデータ）から各画素毎に対応するセルの総出力レベルを算する補正値、明確化を行ったデータを算出するデータに対して対称換する変換変換、再変換フィルタ26を照明する光の光量むらに応じて適度変換後のデータを補正するシェーディング補正、該シェーディング補正を行ったデータのうちの入射光に対応した信号が出力されるセル（所謂欠陥画素）のデータを周囲の画素のデータから検出して新たに生成する欠陥画素補正の各処理を順に行う。ラインセンサナ補正部36の出力量は1/0コントローラ38の入力線に接続されており、ラインセンサナ補正部36で前記各処理が施されたデータは、ラインセンサナ補正部36で前記各処理が施されたデータとして1/0コントローラ38に入力される。

【0043】I/Oコントローラ38の入力端は、イメージプロセッサ40のデータ出力端にも接続されており、イメージプロセッサ40からは画像処理（解像度後処理）が行われる。パーソナルコンピュータ42は、コントローラ38の入力端はパーソナルコンピュータ42にも接続されている。パーソナルコンピュータ42は、拡張スロット（図示省略）を設けており、この拡張スロットには、デジタルシリアルカルメラ等によって画像データが書き込まれたデジタルカメラカード、図示しないCD-R書き込まれたことによって画像データが書き込まれたCD-ROMが装着されている。パーソナルコンピュータ42は、R等の情報記憶媒体に対し、データの読み出し/書き込みを行うドライバ（指し省略）、他の情報処理装置と通信を行うための通信制御装置が接続される。拡張スロットを介して外部からファブリアル画像データ（デジタルカメラカードやCD-Rから読み出しし画像データ、あるいは他の情報処理装置から受信した画像データ）が入力される場合、入力されたファブリアル画像データはI/Oコントローラ38へ入力される。

【0044】I/Oコントローラ380の出力は、イメージセンサ400のデータ入力部、ポートセットアップエンジン414、パーソナルコンピュータ42に各々接続されており、更にI/F回路54を介してプリンタ16に接続されている。I/Oコントローラ38は、入力された画像データを、出力部に接続された画素名格納器に逐次的に出力する。

【0045】本実施形態では、写真フィルム26に記録されている画素のフィルム面像に対し、スキャナ12において異なる倍率で2回の読み取りを行う。1回目の読み取りでは、フィルム面像の濃度が非常に低い場合（例えば、比較的低照度での読み取り以下、アレキサンダのネガ画像）にも、ばねガフィルムにおける高亮アングラのネガ画像）にも、CCDセンサ3で蓄積電荷の飽和が生じないように決定した読み取り（写真フィルム26に照射しようとするR、G、Bの各波長成分の光量、CCDセンサ3の暗雑増幅率（暗時間）で写真フィルム26の面の読み取りが行われず、

る。このプレスキャンによって得られたデータ（プレスキャンデータ）は、I/Oコントローラ38からオートセットアップエンジン44へ入力される。

【0046】オートセットアップエンジン44は、CPU46、RAM48（例えばDRAM）、ROM50（例えば記憶内容を擦除可能なROM）、出力ポート52を備え、これらがバスを介して互いに接続されて構成されている。オートセットアップエンジン44は、1/Oコントローラ38から入力されたプレスキャンデータに基づいてフィルム画像の画素位置を判定し、写真フィルム26上のフィルム画像記録領域に対応するプレスキャン画像データに基づいて、フィルム画像のサイズ（プレスキャン画像データ）を抽出する。また、プレスキャン画像データに基づいて、フィルム画像のサイズを判定すると共に画素毎の画像特徴量を算出し、プレスキャンを行った写真フィルム26に対し、スキャナ12が比較的高解像度での画素の読み取り（以下、フラインスキャンと称す）を行う際の基礎条件を決定する。そしてコマ位置及び読取条件をスキャナ12に出力する。

【0047】また、オートセットアップエンジン44は、プレスキャン画像データ（又は低解像度化したフィルム画像データ）に基づいて、画像中の主要部（例えば人物の頭に対応する領域（被写体）の抽出を含む画像特徴量の算出）を行い、スキャナ12がフラインスキャンを行うことによって得られるフラインスキャン画像データ（又はフィルム画像データ）に対する各画素の画像処理の処理条件を算出し、より自動的に決定し（セットアップ演出）、決定した処理条件をイメージングプロセス40へ出力する。

【0048】パーソナルコンピュータ2には、ディスプレイ、キーボード、及びマウスが接続されている。(何れも図示省略)。パーソナルコンピュータ2は、オートセットアップエンジン4から低価格帯の画像データ1をダウンロードし、オートセットアップエンジン4によって決定された画像処理の処理条件を抽出し、取り込んで実行する。オートセットアップエンジン4は、低価格帯の画像データ1に基づき、高価格帯画像データを生成して、イメージプロセッサ40で行われる画像処理と等価な画像処理を低価格帯画像データに対して行って、シミュレーション画像データを生産する。

【0049】そして、生成したシミュレーション画像データを、ディスプレイに画像を表示するための号に発生し、該図面に基いてディスプレイにシミュレーション画像を表示する。また、表示されたシミュレーション画像に対してオペレータによって調整等の操作が行われ、決定結果として処理条件の修正を指示する情報（キーボードを介して入力されると、該情報をサポートセットアップエンジン4へ出力する。これにより、サポートセットアップエンジン4では画像処理の処理条件の所定修正等の処理が行われる。

【0050】一方、スキヤナ12でフィルム面像に対し

や製品等の大まな生産において、生産された部品や製品等が所定に搬送されている状態を画像符号から所定のタイミングで抽出し、抽出した画像符号から、主要部に相当する領域として前記部品や製品等に対応する領域を抽出する等の場合に請求項5の発明を適用することも可能である。

この場合、抽出した主要部領域は、例えば生産した部品や製品等を自動的に検出する等を利用することもできる。

[0127]

【発明の効果】以上説明したように請求項1及び請求項5記載の発明は、画像中の人物の顔に相当すると判定される領域を所定数の小領域に分割すると共に、小領域内における速度又は傾度の変化の傾度及び変化の大きさに関連する特徴量を各小領域毎に求め、人物の顔に相当する領域を所定数の小領域に分割したときの各小領域の所定特徴量の関係を表すパターンと照合して、候補領域の人物の顔に相当する領域としての速度を評価する領域、人物の顔に相当する領域としての傾度を評価する領域を簡易な処理により精度良く抽出することができる、という優れた効果を有する。

【0128】請求項2記載の発明は、請求項1の発明において、人物の顔の輪郭を構成する個々の領域に相当する領域が異なる小領域内に位置するように分割対象領域を分割するので、上記効果に加え、候補領域に対する人物の顔に相当する領域としての傾度の評価をより精度良く行うことができる、という効果を有する。

【0129】請求項3及び請求項7記載の発明は、人物の顔に相当すると判定される候補領域内の速度又は傾度の分布に基づいて、人物の顔の特定の部分に特有の速度又は傾度のパターンが生じている領域を抽出し、抽出した領域の候補領域内における位置、候補領域との面積比、速度又は傾度のヒストグラムの形状の少なくとも一つに基づいて、抽出した領域の特定の部分に相当する領域としての整合性を判定し、候補領域の人物の顔に相当する領域としての傾度を評価するので、人物の顔の内部構造に基づき、人物の顔に相当する領域を簡易な処理により精度良く抽出することができる、という優れた効果を有する。

【0130】請求項4記載の発明は、請求項3の発明において、高速度方向又は低速度方向に凸の速度又は傾度のパターンが生じている領域を抽出し、抽出した領域の内部に凸の速度又は傾度のパターンを判定する、又は低速度方向又は高速度方向に凸の速度又は傾度のパターンが生じている領域を抽出し、抽出した領域の内部に凸の速度又は傾度のパターンを判定するので、上記効果に加え、候補領域に対する人物の顔に相当する領域としての傾度の評価をより精度良く行うことができる、という効果を有する。

【0131】請求項5記載の発明は、画像中の主要部に

相当すると判定される候補領域の傾度又は速度以上の場合に、候補領域との傾度の差が所定範囲内の画素から成る背景候補領域を、候補領域外の範囲内で排除し、抽出された背景候補領域の候補領域に対する面積比が所定値以上の場合、又は抽出された背景候補領域が画像中の周縁部に存在している場合に、候補領域に対する主要部領域に相当する領域としての傾度の評価を低くするので、画像中の背景に相当する領域が主要部に相当する領域として抽出されることを抑制できる、という優れた効果を有する。

【0132】請求項8記載の発明は、画像中の人物の顔に相当すると判定される候補領域を抽出する第1のステップ、抽出した候補領域を所定数の小領域に分割すると共に、小領域内における速度又は傾度の傾度及び変化の大きさに関連する特徴量を各小領域毎に求める第2のステップ、各小領域毎に求めた特徴量を、人物の顔に相当する領域を所定数の小領域に分割したときの各小領域の所定特徴量の関係を表すパターンと照合し、候補領域の人物の顔に相当する領域としての速度を評価する第3のステップを含む処理をコンピュータに実行させるためのプログラムを記憶媒体に記録したので、人物の顔の内部構造に基づき、人物の顔に相当する領域を簡易な処理により精度良く抽出することができる、という優れた効果を有する。

【0133】請求項9記載の発明は、画像中の人物の顔に相当すると判定される候補領域を抽出する第1のステップ、抽出した候補領域内の速度又は傾度の分布に基づいて、人物の顔の特定の部分に特有の速度又は傾度のパターンが生じている領域を抽出する第2のステップ、抽出した領域の候補領域内における位置、候補領域との面積比、速度又は傾度のヒストグラムの形状の少なくとも一つに基づいて、抽出した領域の特定の部分に相当する領域としての整合性を判定し、候補領域の人物の顔に相当する領域としての傾度を評価する第3のステップを含む処理をコンピュータに実行させるためのプログラムを記憶媒体に記録したので、人物の顔の内部構造に基づき、人物の顔に相当する領域を簡易な処理により精度良く抽出することができる、という優れた効果を有する。

【図1】本発明に係る画像処理システムの概略構成図である。

【図2】第1実施形態に係る候補領域抽出・速度傾度処理の内容を示すフローチャートである。

【図3】背景領域判定処理の内容を示すフローチャートである。

【図4】(A)は顔候補領域の分割、(B)は分割によって得られた所定数のブロックと照合するためのマッチング用パターンの一例を示す概念図である。

【図5】速度変化値（エッジ強度）を求めるための微分フィルタの一例を示す概念図である。

【図6】(A)及び(B)はマッチング用パターンとの一致度に応じて候補領域に重み点数を設定するためのマップを各々示す概念図である。

【図7】背景領域が候補領域として抽出される可能性が低い画像の一例を示すイメージ図である。

【図8】(A)は背景領域である可能性が比較的低い候補領域に対する重み点数を修正するためのマップを示す概念図、(B)は前記候補領域が存在していた場合の候補領域判定用の傾度の差を説明する概念図である。

【図9】第2実施形態に係る候補領域抽出・速度傾度処理の内容を示すフローチャートである。

【図10】(A)は候補領域内の速度が所定値以上の高速度領域の分布の一例を示すイメージ図、(B)は候補領域

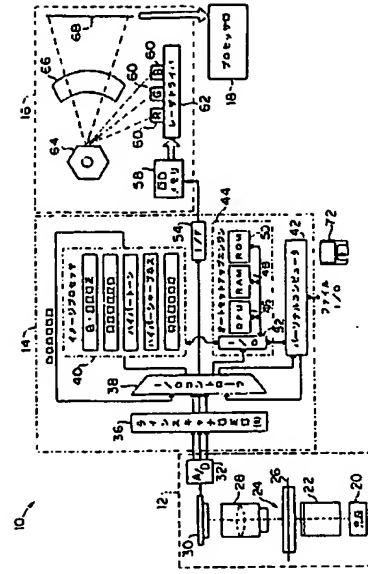
のうちの傾度に相当する領域内における速度変化の一例を示す概念図である。

【図11】(A)は候補領域内の傾度が所定値以上の高速度領域の分布の一例を示すイメージ図、(B)は候補領域のうちの傾度に相当する領域内における傾度変化の一例を示す概念図である。

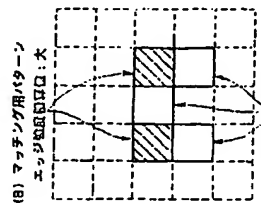
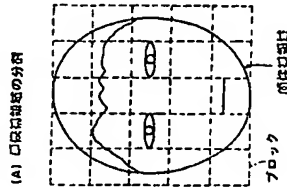
【符号の説明】

- 10 画像処理システム
- 14 画像取得装置
- 40 イメージプロセッサ
- 44 オートセットアップエンジン
- 72 情報記憶媒体

【図1】



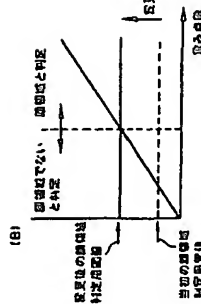
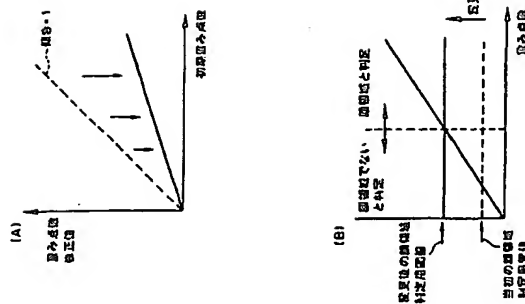
【図4】



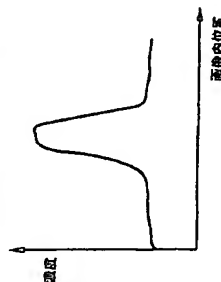
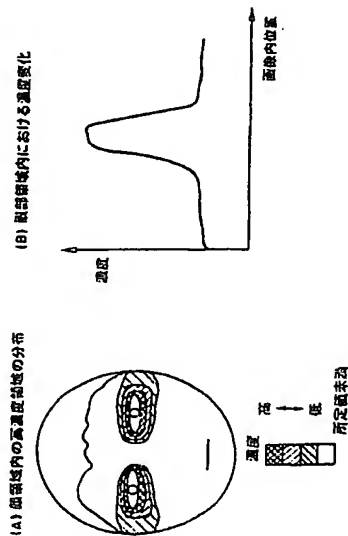
【図5】



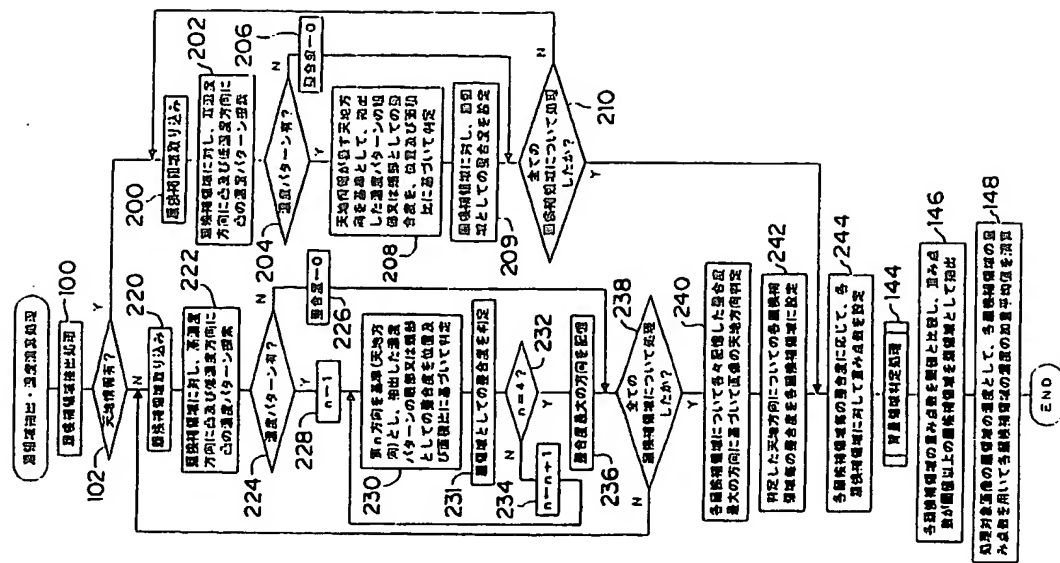
【8】



【01圖】

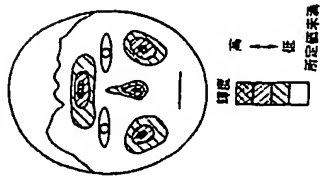


【64】



【図11】

(A) 顔面内の高圧度領域の分布



(B) 顔面内における高圧度変化

